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ABSTRACT

This activity notebook for grade 4 is one in a series developed in response to the concern for energy conservation. It contains activities that stress an energy conservation ethic and includes many values clarification activities for grade four. The packet is divided into two parts and provides the teacher with background information, concepts and objectives, and activities for each part. Part one is concerned with energy conservation activities. Two annotated bibliographies, one for teachers and the other for students, are also included. The teacher is provided with pages for duplication. An evaluation form and a list of resources are also a part of this activity packet. Revisions include updated background information, three additional activities involving solar energy and consumption, plus a revised bibliography. (Author)

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Conservation Activity Packet

Grade 4



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ENERGY CONSERVATION ACTIVITY PACKETS

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INTRODUCTION TO ENERGY PACKETS

The energy shortages and emergencies with which we are faced attest the treatment humans have given to their natural surroundings. Not only do we experience personal inconveniences, but we also see severe economic and environmental consequences. Our nation has arrived at a time when it needs to reevaluate where it is going, at what speed, and how it will eventually arrive at that goal. The National Academy of Sciences generally agrees that the reserves and resources of domestic oil, gas and coal will satisfy energy needs in the United States until the year 2000. Presently the United States doubles its energy consumption every 13 years. In 1975, electric companies burned 507 million barrels of oil to generate electricity, 500 million barrels were burned to heat factories. Much of the oil and natural gas consumed could be replaced by coal, thus drastically reducing oil imports.

The instructional program in a school can examine this energy situation with reason and logic. When a social issue is integrated into the total curriculum, it helps children to apply what they are learning. The educational process can help students become aware of the alternatives and consequences in regard to energy, then guide them to choose a value. Students can learn that it is just as exciting to make something last as it is to develop something new.

Through use of the enclosed materials and activities, it is our intent to stress a conservation ethic. The conservation ethic means more than turning lights off; it has wider implications such as developing new industries to recycle metals, making more durable products, and prioritizing fuel uses.

Our values show what we tend to do with our limited time and energy. They are related to the experiences that shape them. In order to help children develop clearer values, teachers must help them use the process of valuing.

- | | |
|----------|--|
| | (1) freely |
| | (2) from alternatives |
| Choosing | (3) after thoughtful consideration of the consequences of each alternative |
| Prizing | (4) being happy with the choice |
| | (5) willing to publicly affirm the choice |
| Acting | (6) doing something with the choice |
| | (7) repeatedly, incorporating in some pattern of life |

Students become much more purposeful when they have been given opportunities to clarify their values.

Each packet contains values clarification exercises designed to carry out the stated objectives. The teacher may wish to use a specific model to

develop more exercises. You will find that the valuing process is another tool for the teacher. When used, it leads children from apathy and confusion toward positive learning and life-styles.

The goal of providing the types of activities, which have been included, is to create a growing awareness for the need of dealing with existing energy problems in a positive way. Individual teachers should select objectives which they feel reflect the needs of a particular class. Each packet contains an energy goal and an awareness or accommodation objective. It is imperative to include objectives from each conceptual area as the purpose of these packets is to develop an energy conservation ethic within the students of today that they may become conserving and concerned citizens of tomorrow. Changes may not occur immediately due to home and parental values; however, as they become adults, this learning will show its effects.

Each packet includes many activities for the teaching towards the stated objectives. Teachers need choose only those activities which they feel will accomplish their objectives. As there are often many activities suggested for an objective, the teacher may choose to prepare and offer multiple activities. This could allow students to choose the activity they find most interesting. The teaching of energy and its conservation is designed to be interdisciplinary in order that students see that energy cannot be isolated from our daily lives. This is also important in developing the conservation ethic.

Within the packet, teachers will find transparencies, posters, filmstrips, etc. which may add to the teaching of energy and development of conservation. (These supplementary sheets are grouped together at the end of the notebook behind the colored divider page.) These visual materials plus the activity sheets can be adapted for many uses beyond those suggested, even though a variety of presentation methods is inherent in the notebooks. For example, class, small group, individual, and even family activities are included. In fact, each packet has at least one student interest center or learning station sheets included in the supplementary sheet section. Suggestions and criticisms from teachers, consultants, etc. would be appreciated and considered in keeping these packets suitable for the majority of school systems.

Most young children (7-11) years are in the concrete operational stage as named by Piaget. Such students consider real, concrete things in a systematic, but not abstract manner. Therefore, the activities which have been proposed reflect this and provide for greater awareness, rather than a formal study of energy. Individual teachers know their students best and will need to select items which they feel will be of greatest benefit to the education of the children. This is also the reason the concepts and objectives for the primary grades (K-2) have been combined in one packet. There are some classroom activities which require about 20 minutes each, some 40 minutes, and there are also some activities which can be done at home in order to enable children to work with their families.

AN OVERVIEW OF THE CONCEPTUAL DEVELOPMENT OF
K-6 ENERGY PACKETS AT A GLANCE

ENERGY GOALS

- K-2 The learner becomes aware that all living things require energy.
- The student becomes aware of sources of energy within the learner's home and school.
- The learner becomes aware of uses of energy.
- Grade 3 The learner develops an understanding of how energy affects our lives. (Packet A, Goal 1.00)
- The learner examines the available energy sources. (Packet B, Goal 1.00)
- Grade 4 The learner becomes aware that energy can be changed from one form to another - conversion. (Packet A, Goal 1.00)
- The learner considers energy, its production, use, and conservation as essential in the maintenance of our society as we know it. (Packet B, Goal 1.00)
- Grade 5 The learner develops an understanding of fossil fuels and uses. (Packet A, Goal 1.00)
- The learner recognizes the involvement of energy in Iowa's past, present, and future. (Packet B, Goal 1.00)
- Grade 6 The learner recognizes limits of energy sources. (Packet A, Goal 1.00)
- The learner develops an understanding of alternative sources of energy. (Packet B, Goal 1.00)

Personal Awareness or Accommodation Goal

All packets focus on encouraging the development of a conservation ethic. The Personal Awareness or Accommodation Goals are "Goal 4.00" in the white K-2 notebook and "Goal 2.00" in both packets, A and B, within the 3, 4, 5 and 6 grade level notebooks. Activities in this section encourage students to question the personal importance and implications of that which has been experienced. They utilize the values clarification approach described by Raths, Harmin, and Simon in Values and Teaching.

ENERGY CONSERVATION ACTIVITY PACKETS

GRADE 4

PACKET "A"

TEACHER BACKGROUND MATERIAL
Grade 4 - Packet "A"

The First Law of Thermodynamics states that "energy can neither be created nor destroyed." The Second Law of Thermodynamics says that "in any conversion of energy from one form to another some of it becomes unavailable for future use." Energy is not consumed in our society, it flows through it. This can be seen in the instance of fossil fuels. They are not only sources of energy but provide raw materials for many products. All natural energy conversions are irreversible. The energy converted from one form to another cannot be completely converted back to its original form. Waste heat from energy conversions is discharged into the atmosphere or into rivers and lakes. It is given off by electrical wires, lost from homes and buildings, and lost into the atmosphere by inefficient automobiles. In the end, all of our primary energy ends up as heat and is radiated away to warm the universe.

You may wish to utilize the learning center approach during the study of energy, therefore, in Packet "A" you will find materials and suggestions for this type of approach. The teacher is free to use the materials in any manner which will provide the most educational experience for the students.

Many of the activities in the 4th grade packets require between 20 and 40 minutes depending upon the length of discussion. Some of the activities are designed to be done at home and follow-up provided in the classroom.

GOALS AND OBJECTIVES IN ENERGY CONSERVATION

Grade 4 - Packet "A"

Energy GOAL 1.00

The learner becomes aware that energy can be changed from one form to another--conversion.

The learner:

- 1.1 Describes the transfer of energy in living systems.
- 1.2 Identifies certain civilizations which used only conversions related to wind, fire, falling water, and muscle power.
- 1.3 Sees that a machine changes energy from one form to another.
- 1.4 Recognizes that living organisms change energy from one form to another.

Personal Accommodation GOAL 2.00

The learner will develop a conservation ethic in regard to energy.

The learner:

- 2.1 Acquires experience in making decisions and accepting the consequences of the decisions.
- 2.2 Expresses personal value that is received from energy conservation.
- 2.3 Chooses activities which will utilize conservation of energy in making contributions to the school and community.
- 2.4 Develops an idea of the type of life style desired in consideration of the amount of energy required.
- 2.5 Relates implications for energy conservation to the impact upon natural and man-developed resources.

ENERGY ACTIVITIES
Grade 4 - Packet "A"

Goal 1.00 Learner becomes aware that energy can be changed from one form to another--conversion.

Objective 1.1 The learner describes the transfer of energy in living systems.

- A. Fill a teakettle with water and heat until the water boils. When the steam begins to rise, hold a pinwheel over the spout. Relate the experiment to generators and discuss how heat energy is converted to electrical energy. (1.1)
- B. To help students consider the ways that the sun's energy is transferred to various objects, living and non-living, have them develop and test a hypothesis. A sample hypothesis might be, "All green plants grow better in sunlight than in the absence of sunlight." To test this hypothesis, use two similar plants. (Geraniums work well.) Place one plant in sunlight and the other in darkness as in a closet. Be careful to provide the same conditions for the two plants except for the sunlight. For example, provide equal amounts of water and the same soil type. Use thermometers to keep the heat the same, if possible. Monitor and record changes in both plants daily. After one week, discuss the findings. (1.1)

- C. Credit: My Energy...is Your Energy, Arizona Department of Education, 1974.

A basic principle of energy is evident in popping popcorn. In each kernel of corn there is water and when it is heated it converts to steam. The steam expands and pushes against the skin of the kernel. The kernel soon explodes and you see the white starch of the inside. Now you can eat the experiment! As you do, notice the conversion of butter from solid to liquid when subjected to heat energy. (1.1)

- D. Take a walk with the class to observe conversions of energy. The class uses a list with three columns indicating object, energy source, and product. This list is filled as they proceed on their walk. (Use Data Sheet #1, pg. a) Upon return to the classroom the class can discuss their lists and notice whether anyone noticed something which no one else saw. (1.1)
- E. Use pictures of things the children are familiar with, such as guitar, toaster, lump of coal, flashlight. For each one, Discuss how the energy changes from one form to another. If pictures are not available, use Transparency #1, pg. b. (1.1)

1. Guitar--energy of motion (mechanical) changed into sound energy.
2. Toaster--electric energy changed into heat (thermal) energy and light energy.
3. Lump of Coal--chemical energy changed into heat (thermal) energy and light energy.
4. Flashlight--chemical energy changed into electric energy and light energy.

Students could locate pictures of other items and explain the change of energy--orally, or through drawings.

- E. Set up a balanced aquarium and notice how the energy is converted from one form to another. (1.1, 1.4)

Objective 1.2 The learner identifies certain civilizations which used only conversions related to wind, fire, falling water, and muscle power.

- A. Students compare the sources and uses of energy in a hunting society, a primitive agricultural society, and our own society. Then discuss whether our society should become more, or less, energy intensive. (1.2)
- B. Have the students research a day in the life of an Eskimo. Write a short play which will depict his activities during the day. Present the play to another group and then discuss what energy conversions were used. This activity and the following one can be adapted to any culture you may be studying in social studies. (1.2)
- C. The children can prepare research on a nomadic tribe and then try to reconstruct a day in their lives. The activities of the men, women, and children should be considered. Role-play a scene around an evening campfire where several of the members of the tribe talk about their activities in such a way that it shows the energy conversions used. This role-playing might also be done with puppets. (1.2)
- D. There is an interesting history of civilizations that have made use of solar energy. Have students study the native American cultures from the Southwest USA or the Natchez Indians from the Southeast to learn how they used solar energy. Other possibilities are the Aztecs, Incas or Egyptians. Encourage students to learn about the housing, space heating source, food preparation, and transportation methods. After the study have students build models of buildings, shrines, or villages; demonstrate cooking methods; or demonstrate making the mud bricks frequently used in construction. (1.2)
(Reference: "The Way to Star: A Day", Byrd Baylor.)

Objective 1.3 The learner sees that a machine changes energy from one form to another.

- A. Each student brings in an example of a machine and shows how it moves or changes something. (1.3)
- B. Discuss why people and animals are like machines. (1.3)
- C. Let the students construct and fly a kite. Ask, "What is the energy source? Is there any conversion before it is used?" (1.3)
- D. Conduct an experiment with a flat sled and a roller skate. Attach twine to the sled and to the skate, then put books or other weights on each one. Volunteer students pull the sled and the skate. Which is easier? Which can do the most work? Load them both until the string snaps. With which machine is more energy used? (1.3)
- E. Collect and display toys which show as many conversions of energy as possible. Example: trace back electricity from making the electric train work back to utility company and even back to original source. List the energy conversions. Simpler toys have fewer conversions. (1.3)
- F. Each of the five forms of energy can be converted to another form. This is done with the use of a conversion device. Use the toaster as an example of a device which converts electrical energy into heat energy. The children can prepare toast and explain the conversion they see. List some conversions and have students name the conversion device used for each one. (1.3)
 1. Electrical to sound (telephone, radio)
 2. Chemical to heat (fossil fuel, match)
 3. Electrical to heat (spark plug, toaster)
- G. Coal is burned and releases heat energy to set water boiling and changes it into steam. The steam rushes through pipes and hits the propeller-like blades on a turbine shaft. The mechanical energy which was produced by a rotating shaft sets a generator to producing electricity. (Transparency #2, pg. c.) (1.3)
- H. Use Transparency #3, pg. d, to help the class discover how humans have created extra energy steps in their need to get somewhere faster. Discuss, then let the class share thoughts as to what could be done to eliminate some of the extra energy steps. (1.3, 1.4)

Objective 1.4 The learner recognizes that living organisms change energy from one form to another.

- A. Demonstrate to the class how burning wood converts the energy which is stored in the wood into heat energy and light energy. (1.3, 1.4)
- B. Discuss food chains or food webs. Students trace energy sources and discuss the conversions which occur. (1.4)

Goal 2.00 Personal Accommodation: The learner will develop a conservation ethic in regard to energy.

Objective 2.1 The learner acquires experience in making decisions and accepting the consequences of the decisions.

- A. Have students compare light bulbs (fluorescent and incandescent). Do this carefully and warn the students that when they touch things they do it quickly and be careful not to get burned. First let them feel both types. Which type seems to give off the most heat? Secondly, let the students graph the length of time it burns and temperature released. From this the students could discuss actions they could take. (2.1)
- B. Bring in a variety of waste products (egg cartons, scrap material, cans, etc.). Let the students first list at least 10 uses they can think of for one of the waste products. Then have them consider what energy must be utilized in the process of recycling--encourage them to select a use for the product which uses the least amount of energy. Discuss what they have thought of and also discuss other alternatives to dealing with the waste problem. Display some of the results of ideas for recycling waste products--let the children use their imaginations! (2.1)

Objective 2.2 The learner expresses personal value that is received from energy conservation.

- A. Students set up a display showing ways to save energy by using fewer conversions. This display should be placed in a public library, shopping mall, or area through which many people pass. (2.2, 2.3)
- B. Students write child-authored books on the topic of energy conversion and energy conservation. These can be shared with other grade levels and could also become a part of the library. (2.2, 2.3)
- C. Credit: A Teacher's Handbook on Energy, Colorado Department of Education, Denver, Colorado 80203.

Develop with the class a list of 15-20 pairs of alternative ways of doing things commonly found in our way of life, such as the following:

1. Dishwasher vs. doing dishes in the sink
2. Fan vs. air conditioner
3. Power mower vs. hand mower
4. Electric razor vs. blade razor
5. Bath vs. shower

6. Gas stove vs. electric stove
7. Electric sweeper vs. broom
8. Automobile vs. bicycle

Ask the students, working in pairs, to select one of the alternatives and to compare/contrast the amount of energy used and the benefits received from the alternative they have selected. Encourage students to think seriously about the advantages of both alternatives. Ask each pair of students to identify to the class the alternative they prefer and then see if the class supports or does not support their choice. (2.2, 2.3)

Student Model, i.e.	Dishwasher	Dishes in Sink
	Adv. Disadv.	Adv. Disadv.

Objective 2.3 The learner chooses activities which will utilize conservation of energy in making contributions to the school and community.

- A. How do you know when you really are saving energy and when you are using too much? Guidelines will help you know.
 1. Stay as close to the source of things as possible.
 2. Buy and use long-lasting, efficient products.
 3. Look at the whole energy picture of things you use.

Show Transparency #4, pg. e to help children visualize this. Have them choose another product and draw a pyramid for it. (2.3, 2.4, 2.5)

- B. The class can prepare a skit or play about energy and energy conservation. Light the stage only with candles or flashlights. This could be presented in a number of ways: to another class, the entire school, or to parents. (2.3)

Objective 2.4 The learner develops an idea of the type of life style desired in consideration of the amount of energy required.

- A. Draw a mural depicting the major means of heating homes in the year 1850, 1950, 2050. Field trips or resource people will serve as excellent sources for the first two dates. Imagination serves well for the future date! (2.4)
- B. Students interview other people to find out what the "good life" is. Interviews should include adults and fellow students. These interviews could be taped and then discussed by the students. (2.4)

Objective 2.5 The learner relates implications for energy conservation to the impact upon natural and man-developed resources.

- A. A large portion of energy is used in the packaging of such food items as cooking oil in aerosol cans, flavorings, TV dinners, frozen foods, canned beverages. There are some energy conserving practices which would also increase the amount of nutrition available for consumers. Have the students determine these energy conserving practices and take action if they feel action is needed. Action could include letters, distributing posters, speaking to groups, etc. (2.5)

Some energy conserving practices:

1. Home gardening
2. Fruit growing
3. Eat more vegetables and less meat
4. Reduce the use of over-processed food
5. Purchase beverages in the returnable containers
6. Purchase more unpackaged foods
7. Encourage development of more stores which allow you to bring in your own containers

LEARNING STATIONS TO HELP CHILDREN FIND ENERGY
SAVING PRACTICES

Station #1

Wise Use of Water

Materials: reference books and/or pamphlets on water conservation and home energy conservation, experiment sheets (Masters #1, 2, 3, pp. f-h)

Directions: These experiments need to be done at home. Take one worksheet home, complete it, and return it to the basket on this table. Then take another worksheet and do the same. You need to complete two of these experiments before you proceed to the next station.

Station #2

Insulation

Materials: ice cubes, water glass, "fish tank" thermometer, cardboard box (just large enough for the water glass), cotton balls, fruit juice cans, black paint, brush, newspaper, styrofoam packaging material, cloth, plastic, insulating material from local contractor, direction sheets for the experiments (Masters #4, 5, 6, pp. i-k)

Directions: Read each direction sheet carefully. Some of these can be done at school while others should be completed at home. When you have completed an experiment, put your sheet in the basket on this table. You need to complete two of these experiments before you proceed to the next station.

Station #3

Packaging Practices

Materials: experiment sheets, display of types of packaging available today in the stores, scale (Masters 7, 8, 9, 10, pp. l-o)

Directions: Read the experiment sheet carefully. Some of these are to be done at home, some at both home and school. When you complete an experiment, put your sheet in the basket on the table. You need to do two experiments before going to the next station.

Station #4

Household Appliances

Materials: experiment sheets (Masters 11, 12, 13, 14, 15, 16, pp. p-u), glue, magazines, catalogs, home appliance advertisements, white drawing paper

Directions: Read the experiment sheets carefully. Some of these are to be done at home and others at school. When you complete an experiment, put your sheet in the basket on the table. You need to do two experiments before going to the next station.

The teacher determines the time limit for each station. This will help the students to organize and keep moving on the experiments.

ENERGY CONSERVATION ACTIVITY PACKETS

GRADE 4

PACKET "B"

TEACHER BACKGROUND MATERIAL
Grade 4 - Packet "B"

About one third (3,000 hours per year) of a person's time is left for recreation after school, sleep, and working around the house. Hobbies, travel, sports, hiking, etc. are all desirable but they also all require energy. Some types of recreation use only human energy while others use a combination of human and machine. Fishing may seem to require very little fuel but some people fly or drive great distances to get to a good fishing hole. Use of leisure time is a personal matter but thought should go into the amounts of energy consumed in each activity and changes made if necessary.

During the 1973 oil embargo, people began to understand how closely energy is tied to, and interwoven in, daily life. Energy prices rose and automobile buying habits of Americans changed. Private citizens were called upon to reduce thermostat settings, reduce travel, and lower highway speed. These measures minimally altered life styles. However, demand has increased and consumption of electricity doubles almost every 10 years. The crisis brought attention to the problems of diminishing energy resources, increased dependence on imported oil, and environmental costs.

Energy is necessary for comfort, communication, and transportation. The industrialized nations are the large consumers of energy. High standards of living have resulted in high per capita consumption.

Many of the activities in the 4th grade packets require between 20 and 40 minutes, depending upon the length of discussion. Some of the activities are designed to be done at home and follow-up provided in the classroom.

GOALS AND OBJECTIVES IN ENERGY CONSERVATION

Grade 4 - Packet "B"

Energy

Goal 1.00 The learner considers energy, its production, use and conservation as essential in the maintenance of our society as we know it.

The learner:

- 1.1 Expresses an understanding of energy needs.
- 1.2 Expresses an understanding of the energy shortage.
- 1.3 Becomes aware that humans in some technological cultures greatly increased their consumption of energy in recent years.
- 1.4 Considers that human beings use energy to create special ecosystems such as cities, etc. at the expense of natural ecosystems.
- 1.5 Recognizes that energy is closely related to transportation, consumers, industry, etc.
- 1.6 Discovers uses of energy in commercial, industrial, residential, and transportation areas.
- 1.7 Discovers ways in which human beings use energy in leisure time activities.
- 1.8 Formulates value judgements concerning his/her life style and energy utilization.

Personal Accommodation

Goal 2.00 The learner will develop a conservation ethic in regard to energy.

The learner:

- 2.1 Acquires experience in making decisions and accepting the consequences of the decisions.
- 2.2 Expresses personal value that is received from energy conservation.
- 2.3 Chooses activities which will utilize conservation of energy in making contributions to the school and community.
- 2.4 Develops an idea of the type of life style desired in consideration of the amount of energy required.
- 2.5 Relates implications for energy conservation to the impact upon natural and man-developed resources.

ENERGY ACTIVITIES
Grade 4 - Packet "B"

Goal 1.00 The learner considers energy, its production, use and conservation as essential in the maintenance of our society as we know it.

Objective 1.1 The learner expresses an understanding of energy needs.

A. Divide the class into groups of five with each group representing a family of five: father, mother, and three children. The groups are told that because of a very critical shortage of natural gas and fuel oil, their winter heat allocation is being reduced. Challenge each group to prepare the best list they can of how they will deal with the problem. Ask them to think about and list what they can do to keep heat in or cold out of their homes. What can be done by the father? The mother? The children? How can they still be comfortable if they reduce the temperature? (Use Sheet #1, pg. v.) Students will see that every family member can be involved and helpful in confronting such a problem. (1.1, 2.1, 2.4)

B. Pretend that a major disaster has hit the community! The sources of electric power and water have been damaged. Describe what activities your family would participate in under these conditions. Underline each activity that is normally performed by power. (1.1, 1.2, 1.8)

C. Use the following list of words as a vocabulary list and add to it throughout the study. These could be alphabetized, etc. This would be a good language arts lesson. (1.1, 1.2)

blackout
energy
energy crisis
fuse
generator
petroleum
fossil fuel
hydropower

D. Supply each child with a copy of Master #1, pg. w. If you think your class could accomplish this better as a small group activity then do it in that manner. They should attempt to list more examples of energy users and for each item they check the forms of energy that power the user. (1.1)

Objective 1.2 The learner expresses an understanding of the energy shortage.

- A. The following activity should help children see that shortages result from the relationship of a product's value to its availability. Mark off a grassy area somewhere around the school building (about 10' x 20'). In the grass scatter 150 colored gumballs or marbles (25 each of red, green, white, black, blue, orange). Set a time limit and see how many the students can recover. Have the children explain why certain colors were more difficult to find. (1.2)
 1. What products can you think of that are high in price because they are in short supply?
 2. What raw materials are high in price because they are wanted by so many people for so many things?
- B. Either read to the class or obtain enough copies to assign as a reading lesson, the reprint from Ranger Rick, "The Best Present of All." A single copy is available free from the National Wildlife Federation, 1412 Sixteenth Street, N.W., Washington, D.C. 20036. The class may wish to present it as a play or even a puppet show. (1.2)
- C. Announce to the class that there are no more paper towels and no more drawing paper. Ask them to think of ways these problems can be solved without using money and more energy. These ways can be listed and the better ones actually tried for a specified period of time. (1.2)
- D. Ask the principal's permission to set aside one day for minimum usage of electricity. Only cold lunches would be eaten; no audiovisual equipment would be used; there would be no bells, electric clocks, intercom. At the end of the day ask the children to write down their thoughts and feelings. (1.2)

Objective 1.3 The learner becomes aware that humans in some technological cultures greatly increased their consumption of energy in recent years.

- A. Have the students speculate and list five reasons why stores and offices today use almost twice the electric energy as they did 10 years ago. Stores and offices may be contacted to obtain firsthand information. (1.3, 1.6)
- B. Have the students discuss what they would do with the time they normally watch television, if they were not allowed to watch television as much. They could list activities they would participate in, then decide for each activity whether they were using more or less energy. (1.3, 1.4)
- C. The children discuss how buying a house, car, toys, appliances, etc. is related to the energy crisis. How could buying habits change in order to ease the energy shortage? (1.3, 1.4)

Objective 1.4 The learner considers that human beings use energy to create special ecosystems such as cities, etc. at the expense of natural ecosystems.

A. Ask students to bring in toys. Then let them attempt to find answers for such questions as:

1. How long has this item been on the market?
2. Was it marketed to fill a need or did it create its own need?
3. Can you think of other things to do that require less energy?
4. Did the children in colonial days have the same needs for recreation as we have today? What did they use?

They could then set up a display showing electrically powered toys compared to the non-powered counterparts. (1.4)

- B. Use the information on Transparency #1, pg. x, to discuss how man uses energy to create his own systems and thus sometimes causes a change in natural systems. Take a walk to find specific local examples of this. (1.4)
- C. Have the students contact the local utility company to help you calculate the proportion of power used in your city by industrial, commercial, and residential users. Compare the power use of a large city with that of a small one. (1.4, 1.5, 1.6)
- D. Invite a local grandmother or grandfather to discuss how energy use has changed during his or her lifetime.
- E. Obtain a number of old and new magazines. Compare the different energy uses portrayed in each. (1.4, 1.7, 2.4)
- F. Each student should choose a city they would like to travel to. Then they can prepare written directions for traveling from one city to another by bus, train, auto, or airplane. They will need to check with the offices of these transportation companies so that it will be as accurate as possible with directions to terminals. Choose a few students to read their directions. (1.4, 1.5, 1.6)
1. Which method of travel offers the easiest set of directions?
 2. Which method do you think would be the fastest? The slowest?

3. What restriction has been placed on automobile travel?
 4. Are the public transportation facilities as good as they should be? Why or why not?
 5. Which method of travel is the most expensive? Why?
- G. Continue learning more about transportation. Find out what the major means of transportation are in your community. Visit as many of these places as possible, examine the facilities, compare cost per person for the various types of transportation, ask if more people are using this particular form of transportation than one year ago. (1.4)

Objective 1.5 The learner recognizes that energy is closely related to transportation, consumers, etc.

- A. The class should be taken to an intersection, using all proper and necessary precautions. They should use Survey Sheet #2, pg. y, to tally the number of each type of vehicle they see in a 10 minute period. This should be done daily for one week. Compile information on a chart, or simple graph. Discuss how energy is used in the area of transportation. (1.5, 1.6)
- B. Conduct a survey of bike and car use by students in the school. Include questions about why more students don't ride bikes. The class presents findings and recommendations to the student council and administration. Divide the class into as many groups as there are grade levels. (Survey Sheet #3, pg. z) (1.5, 1.6)
- C. Students pretend they are a family that has just learned they are to conserve gasoline. Role-play the family's efforts. (1.5, 1.6, 2.4, 2.5)
 1. What are gasoline necessities? Luxuries?
 2. Whose needs should be served first?
- D. Have the children write a story about transportation in the future. This should be after a discussion of what is happening now and provide a basis for making careful predictions about the future. The story should include the need for new transportation, possible costs, and types of energy used to operate the vehicles. (1.5, 1.6)
- E. Credit: Energy, Michigan United Conservation Clubs, P.O. Box 30235, Lansing, Michigan 48909.

Many of the life styles that Americans choose require the use of private automobiles. An experiment in West Germany had two drivers sent on a 1,000 mile trip. They had identical cars but one was a slow driver and one was a fast driver. Results: Transparency #2, pg. aa. (1.5, 2.4)

	<u>Slow Driver</u>	<u>Fast Driver</u>
Distance covered	1,000 miles	1,000 miles
Elapsed Time	20 hr., 43 min.	20 hr., 12 min.
He passed	645 cars	2,004 cars
He was passed by	142 cars	13 cars
He used brakes	652 times	1,339 times

Discussion for the transparency:

1. How much time did the fast driver save? (31 minutes out of 20 hours)
2. How many more times did the fast driver have to apply the brakes?
3. The fast driver had three times the accident exposure so had more wear and tear on himself. He also used 10 gallons more of gasoline. Use \$1.50 as the average price per gallon of gas. How much money did the slow driver save? ($\$1.50 \times 10 = \$15.50$)
4. You can add four miles per gallon to your mileage by driving 50 mph instead of 70 mph.

Objective 1.6 The learner discovers uses of energy in commercial, industrial, residential, and transportation areas.

- A. Distribute copies of *Master #2*, pg. 66, to students. This contains some common household appliances which are operated by electricity. Ask the children to put a check (✓) by those items they have in their own homes, and to put a star (*) next to those they use themselves. Tally the responses in class and discuss. (1.6, 1.8, 2.4)
1. Which appliances seem to be in everyone's home?
 2. Which of the checked items are the most essential? Is it possible to agree?
 3. Would everyone in the world give the same responses on the checklist?
 4. Why do Americans consume as much electrical energy as they do?

5. If you were asked to reduce the amount of electricity you consumed, which items would you be most willing to give up?
6. Who should decide which items you will give up?

Conduct experiments related to household uses of energy and appliances, lighting, etc. Use copies of masters from Packet "A" - Grade 4 (Learning Stations) for directions for groups of students. These experiments are taken from Energy Conservation - Experiments You Can Do..., Thomas A. Edison Foundation, Inc., 1974. (1.6, 2.4)

Objective 1.7 The learner discovers ways in which human beings use energy in leisure time activities.

- A. Prepare a data sheet (Data Sheet #4, pg. cc) on vacations for the past three years--amount of travel involved, etc. Plan, with parents, a new kind of vacation. Suggest that instead of driving from one motel to another, find one place to spend the whole vacation. Use ideas that include tennis courts, backpacking, swimming, nature walks, and other energy-conserving activities. Include a note to parents explaining what you want them to do and asking that the data sheet be returned. (1.7, 1.8)
- B. Have the children take an imaginary trip to anywhere they want to go. They should be ready to tell the class whether anyone will be going with them, what would be needed in order to take the trip, how they would get there, whether many people are there, and whether it is a natural or man-made environment. (1.7, 1.8)
- C. Discuss hobbies with the class. Encourage the students to bring in their hobbies to share with the class. Also discuss hobbies they wish to have. Talk about how much energy is involved in the various hobbies and their development. (1.7, 1.8)

Objective 1.8 The learner formulates value judgements concerning his/her life style and energy utilization.

- A. As a class, develop a list of typical household devices that consume energy ("Energy Eaters"). Possibilities are: the automobile, laundry equipment, furnace, air conditioner, lighting, water heater, or humidity control equipment. Follow these steps:
 1. Using Master #3, pg. dd, have the students individually list the energy consuming devices in order of importance to his/her family based on his/her opinion.
 2. Next the students should circle the "Energy Eater" with an energy consumption (or appetite) that could be most easily reduced. The student is to explain in writing how the device or the way it is used would be changed.

3. The students need to consider how the family's activities, habits, work, and comforts at home would be affected by the changes spelled out in #2 to reduce energy consumption.
4. Have the students describe how willing they are to make the necessary behavior changes to put into action their ideas. The student chooses a number that most clearly represents his/her attitude: 5 - Very willing to change; 4 - Willing to change; 3 - No definite feelings about changing; 2 - Unwilling to change; 1 - Very unwilling to change. (1.8)

B. It could be very interesting to see how the students' value judgements vary from those of older individuals.

1. Each student should select a teenager, adult, and senior citizen to complete Master #3, pg. da, as described in Activity A above. Use the same class list as developed in Activity A.
2. A class chart should be developed to record the results. Teens, adults, and senior citizens should be recorded in groups, listing the activity each person targeted to change and the number they chose to indicate his/her willingness to change.
3. Which household device was most frequently listed by each group and by everyone polled? What group was most willing to make a change? (1.8)

Goal 2.00 Personal Accommodation: The learner will develop a conservation ethic in regard to energy.

Objective 2.1 The learner acquires experience in making decisions and accepting the consequences of the decisions.

- A. Ask the students to examine a weekly grocery bag at their home and bring the unnecessary packaging they find to school. Examples might include the polyshrink wrap on meat, cartons for toothpaste, plastic bags for carrots, double wrap on frozen food, etc. Write letters to the various companies explaining the need to conserve and how they can help. Have the children include suggestions for alternative packaging. (2.1, 2.3)

- B. Credit: Energy Activities for the Classroom--1976, Herbert L. Coon and Michele Y. Alexander, ERIC Center for Science, Mathematics, and Environmental Education, Ohio State University, 1200 Chambers Road, Columbus, Ohio 43212.

In most countries of the world, food purchased in grocery stores, bakeries, and meat markets is not wrapped in polyethylene or placed on styrofoam trays and then wrapped. The shopper brings her own shopping bag to market and places the unwrapped lettuce, unbagged oranges, and other purchases directly in her shopping bag. Much of the energy used to produce plastic film, waxed paper, styrofoam trays, and other containers is saved in most countries. After discussion along the lines suggested above, ask each student to interview his/her mother about her willingness to use the simpler system found in most countries. What problems does she see? (Data Sheet #5, pg. ee).

Ask each student to report to the class concerning his mother's judgement on these matters.

If mothers and students believe overpackaging is present, ask the students to write a letter to their supermarket manager. Suggest in the letter that the class would be interested in knowing how he feels about the matter. (2.1, 2.2, 2.3)

C. Situation Cards

Provide each student in your class with a copy of a score card (Data Sheet #6, pg. ff). Pass out the Situation Cards, pp. gg-hh to the students. The student reads the card aloud and has two minutes to make a choice and defend the choice. You may wish to spend several days on this using a different group of students each day.

The rest of the class rates the student from 1-5 (1 for not adequate and 5 for excellent). Then the person is given one more minute to defend or change his position. The class again scores the student. (Situation Cards can be copied from Situation Cards #1 and 2, and mounted on tag board.) (2.1)

- D. Hand out sheets (Master #3, pg. ii) listing some things people have done to achieve desired changes. Students first check (✓) those things which they have done, then (X) those they would like to do. Students should attempt to actually do at least one of the items they have X'd. (2.1, 2.2, 2.3)

E. Unfinished Sentences--Values Clarification Activity

The teacher provides a series of unfinished sentences (examples below) then quickly goes around the room calling on students to complete aloud any one of the sentences with whatever comes to mind. This can be done several times if interest prevails. A discussion can follow with the students elaborating on their answers or questioning other students on their answers. There are also variations which may be used.

Unfinished Sentences: (Relate answers to thoughts on energy)

1. On Saturdays, I like to...
2. If I had had another week of summer vacation, I would...
3. On Sundays, I wish my family would...
4. I think my parents should...
5. The thing that scares me most about the energy shortage is...
6. Someday I am going to...
7. If I could introduce a bill into Congress, I would...
8. Twenty years from now, I hope this country is...
9. When I become a father or mother, I...

Variations

1. Each student writes out all the sentences before the oral whip begins.
2. The students write out their sentences and then break into pairs or trios and discuss their finished sentences.
3. Each student completes the sentences in writing and files them away for later. At a later date do it again and they take out their sentences to see if they have changed their opinions. (2.1, 2.2, 2.3)

Objective 2.2 The learner expresses personal value that is received from energy conservation.

- A. Encourage the children to write editorials for several local newspapers on "What's Good About the Energy Crisis." Once these have been printed, the students can cut them out and post them or include them in energy scrapbooks. (2.2)
- B. Have the children set up a display showing ways to save energy. This display should be placed in a public library, shopping mall, or other area where many people will be exposed to it. (2.2, 2.3)
- C. Encourage the children to write child-authored books on the topic of energy and conservation. These could be shared with children in other grade levels and also displayed in the library. (2.2, 2.3)
- D. Have the students learn how to read electric and gas meters. Actual electric meters are often available, on loan, from the local electric company. Students could easily make cardboard models of electric and gas meters for practice. (Transparencies #3, 4, pp. jj-kk will also help.)

After the students have mastered how to read the meters, ask each student to read the gas and/or electric meters in their homes at an agreed upon time. (Data Sheet #7, pp. ll-mm) They will also be reading the meters exactly one week later to determine how much gas and electricity they use in one week. The data they collect should be recorded on a classroom chart. (Chart #1, pg. nn)

Once the above has been done, announce an "energy saving week." Students are to encourage their families to see how much they can reduce the amount of gas and/or electricity they use before the next weekly reading. Record the data for the second week (Same Data Sheet #7, pp. 22-23). (2.2, 2.3)

1. Which family saved the most? The least?
2. What was the average saving?
3. Was it hard or easy to save energy? Students from the families that saved the most could explain how they were successful.

Objective 2.3 The learner chooses activities which will utilize conservation of energy in making contributions to the school and community.

- A. Students prepare a program and displays about energy and energy conservation to show parents at open house or at a PTA meeting. (2.3)
- B. Have the students participate in an activity where they see which group can prevent an ice cube from melting for the longest time possible. Discuss and display materials that could be used. Divide the class into groups and have the groups propose a plan to preserve the ice cubes, then proceed with the activity. (Data Sheet #8, pg. 20). (2.3)
- C. Action Projects--Values Clarification Activity

If there is a need, students can take action to help, individually or, if there is a consensus, collectively. As they go into action they become clearer about what their values are. The teacher should encourage students to see that they have power, permit them to select or reject any action project, and do not insist that every student participate in every action project. All action should be informed action so reading, learning, discussing are necessary first steps. The class can suggest ideas for projects throughout the study of energy. (2.3)

Objective 2.4 The learner develops an idea of the type of life style desired in consideration of the amount of energy required.

- A. Students interview other people to find out what the "good life" is. Interviews should include adults and fellow students. These interviews could be taped and then discussed by the class. (2.4)
- B. Send copies of Master #4, pg. 22, home with the students. Data Sheet #1, pg. 5, could also be used. This should help to initiate a family discussion about energy and energy conservation. Encourage the students to share ideas with the class from their family discussions. (2.4, 2.5)

- C. Supply each child with a copy of Master #5, pg. qq. This activity would serve as a quick check on the understanding each student has about energy conservation. (2.4)

Objective 2.5 The learner relates implications for energy conservation to the impact upon natural and man-developed resources.

- A. Credit: Energy Conservation: Experiments You Can Do..., Thomas A. Edison Foundation, Inc., 1974.

By now, students have heard the energy-saving hint that asks the public to take showers instead of baths. In this experiment, students can see for themselves that more energy is used in bathing. Students can do this activity as a homework assignment and share the results in class. (Data Sheet #9, pg. rr) Generally, it takes an ounce of oil or a cubic foot of gas, or 1/4 kilowatt-hour of electricity to heat a gallon of water. Ask students to determine how much oil, gas, or electricity it took to heat their bath or shower water. (2.5)

ANNOTATED CHILDREN'S BIBLIOGRAPHY
Grades 4-6

BOOKS AND PAMPHLETS

Adler, Irving and Ruth. Coal. John Day Company, New York, 1965, 47 pp., \$3.96. The book traces the development of coal, how it is mined, its uses, and its many by-products.

Adler, Irving. Energy. John Day Company, New York, 1970, \$3.96. Practical examples of changes from one form of energy to another are given.

Adler, Irving. Petroleum: Gas, Oil, and Asphalt. John Day Company, New York, 1975, 48 pp., \$5.95. This is aimed more towards the science-oriented. It has concise coverage of the story of oils and gas. It includes definitions, formation, location, and extraction of petroleum.

Baer, Steve. Sunspots. Published by Zomeworks Corporation, Albuquerque, NM 87103 - \$3. Basics on solar collectors, with humor.

Baylor, Byrd. The Way to Start A Day. Charles Scribner's Sons: New York, 1978. Text and illustrations describe how people all over the world celebrate the sunrise.

Benrey, Ronald M. Nuclear Experiments You Can Do. Thomas A. Edison Foundation, Inc.: Michigan, 1976 booklet containing some basic facts about nuclear energy and related experiments. It is designed to aid in the understanding of nuclear energy.

Berger, M. Energy from the Sun. Thomas Crowell Co., New York, NY, 1976, 33 pp., \$5.95. (grades K-4).

Central Iowa Power. Play It Safe is a comic-style coloring book for upper elementary students. For free copies contact the local utility in western Iowa.

Dalton, R. All About Energy. American Museum of Atomic Energy, Oak Ridge, TN, 1974. (grades 1-4).

Eldridge, Frank. Wind Machines, report prepared for NSF, 1975, U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 038-000-00272-4, \$2.25. The large-scale format and many excellent photographs and diagrams will capture the attention of students of all ages. History, taxonomy, applications, siting, and performance are some of the chapters included. There is detail and technical data for the engineering-minded teacher as well as general information for the beginning student.

Halacy, D. S. Earth, Water, Wind, and Sun. Harper & Row, New York, 1977, \$8.95. This is probably the best one-volume source of information on energy alternatives written for young people. The professional science writer provides a very readable digest of technical information as well as a history of the development and use of hydro, geothermal, tidal, ocean thermal, wind, bioconverted, and solar energy resources.

Halacy, Daniel S. Nuclear Energy. Franklin Watts, New York, 1978. A First Book. Straight forward text covers the development and current use of nuclear energy. It includes a brief outline of atomic theory, a history of the study of radioactivity, and describes simply how a nuclear power plant operates. The book is appropriate for junior high students. Of special interest to students are a glossary and a section on jobs in nuclear energy.

Halacy, D. S., Jr. The Energy Trap. Four Winds Press: New York, 1975, \$6.95. It describes the energy crisis, its link to the gross national product, and alternatives for current and future fuel resources.

Hart, G. Kimball. How to Cut Your Energy Costs. Washington, D.C., U.S. News and World Report Books, 1978, \$7.95 hardbound. Very readable, this book of practical suggestions and informative diagrams covers the gamut from home improvements to clothing, food, and cars. Recommended for home economics and consumer education classes.

Hoke, J. Solar Energy. Franklin Watts Publ., New York, NY, 1978, \$4.90 (grades 4-6).

Houck, O. A. The Best Present of All. National Wildlife Federation, 1412 16th Street NW, Washington, D.C. 20036, 1976, 24 pp. This popular comic is a reprint from the Ranger Rick magazine. Single copies - free, additional copies - 15¢. (grades 3-6).

Iowa Energy Policy Council. Home Energy Savings Manual is a well written booklet that provides basic energy conservation measures for the home. It has about 75 pp. and is free. Order from the Iowa Energy Policy Council, Capitol Complex, Des Moines, Iowa 50319.

Iowa Power. Several informative and clever publications are available for students through their local utility company in central and southwest Iowa. The following booklets are offered:

The Atom and the Energy Crunch. Reddy Communications, Inc., 1976.

The booklet contains information on the energy crisis, what caused it, nuclear energy, and future energy sources.

Coal and the Energy Crunch. Reddy Communications, Inc., 1976.

Information on sources of coal, coal's value as an energy source, problems due to use of coal, and the importance of planning ahead are discussed.

Electric Utilities and the Energy Crunch. Reddy Communications,

Inc., 1976. The booklet provides information to aid in the understanding of where electricity comes from and why the supply of power is threatened.

Exploring Energy leads classes to unravel the mysteries of energy as they take on 10 different "missions". Through quizzes and games, students become agents charged to turn coal into kilowatts, fill the energy barrel, put the sun to work, and become electricity and natural gas experts.

You and Your Electric Company uses a question and answer format to present information on energy and the operation of a utility company.

- Kiefer, Irene. Underground Furnaces: The Story of Geothermal Energy. William Morrow and Company, Inc.: NJ, \$4.95. Easy but accurate explanations of how four kinds of "hot spots" are formed and how they can be transformed into usable energy.
- Knight, David C. Harnessing the Sun: The Story of Solar Energy. William Morrow and Company: New York, NY, 1976, 128 pp., \$5.95. (grades 5-9). The book tells of past and present work in the field of solar energy and speculations on what may lie ahead.
- Landt, Dennis. Catch the Wind. Four Winds Press, New York, 1976, \$7.95. This survey on windpower in the U.S. and abroad is a very readable introduction for young people. Illustrations are included.
- Marshall, James. Going, Going, Gone? Coward, McCann and Geoghegan, Inc.: New York, 1976, \$5.49. Consideration is given to the waste of energy resources by Americans in this book. It tells us how and why we allow waste to continue.
- Mattison, C. W. Man and His Resources in Today's World. Creative Educational Society: Mankato, MN, 1967, 150 pp., \$6.95. This book on man's resources is well illustrated. It emphasizes conservation and touches on pollution. Also included are future power resources.
- Michaelson, David R. Oceans in Tomorrow's World: How Can We Use and Protect Them? Messner, New York, 1972, \$4.79. Written for junior high students, this book summarizes current and projected methods of using the oceans as an energy source. One section, "Power from the Sea," discusses tidal power.
- Millard, Reed. Natural Resources: Will We Have Enough for Tomorrow's World? Messner, New York, 1972. Each chapter begins with a question relating to a specific natural resource and the possibility of its depletion. Also provides suggestions for further reading.
- Podendorf, Illa. The True Book of Energy. Children's Press: Chicago, 1971. Book relates the importance of kinds of energy to children's own experiences. The book contains short sections and many illustrations.
- Pringle, Laurence. Energy: Power for People. Macmillan Publishing Company, Inc.: New York, 1975, \$6.95. Author urges young people to face the facts about the energy supplies of the earth.
- Ruchlis, Gyman. Thank You, Mr. Sun. Harvey House Publishers: New York, 1966, 45 pp. Ruchlis provides many illustrations of how the sun helps humankind and nature.
- Spetgang, T. Tilly's Catch-A-Sunbeam Coloring Book. Solar Service Corporation, P.O. Box 183, Cherry Hill, NJ 08002, 1976, \$1.50. (grades 2-5).
- Stolp, R. N. and Deluca F. Perspectives on Iowa Coal, 1976. Energy and Mineral Resources Research Institute, Iowa State University, Ames, Iowa 50011. This colorful and readable report provides much local information as well as background material on coal mining in general. Recommended resource for junior and senior high students.

Szulc, Tad. The Energy Crisis. Franklin Watts, Inc.: New York, 1974, 128 pp., \$6.95. Author reveals many disturbing items in relation to the energy crisis and why it is here. The book also contains an explanation of why the energy crisis will continue into the future.

Thomas A. Edison Foundation, Inc. Energy Conservation: Experiments You Can Do. Michigan, 1974, 32 pp. This booklet contains many energy conservation experiments designed to bring about a better understanding of how energy can be conserved at the present time.

Wohlraabe, Raymond A. Exploring Solar Energy. The World Publishing Company, 1966, 89 pp. This resource identifies early history of sun worshippers, and how the sun provides heat and light which can be turned into electricity. It also discusses the uses of solar energy for the future.

Zim, Herbert. Waves. Morrow, 1967, \$3.78. This book offers a useful introduction of tidal waves and underwater earthquakes.

ANNOTATED TEACHER'S BIBLIOGRAPHY

BOOKS: for Teacher's Background and Reference

- American Association of School Administrators. School Energy Crisis: Problems and Solutions. 1977, from AASA, 1801 N. Moore St., Arlington, VA 22209, \$9.95 postpaid, discounts on orders of 2 or more. This is one of the best sources of data on the impact of rising energy costs, present and future, on school operating budgets. Examples of programs to reduce energy bills without capital spending and a guide for planning an energy cost-reduction program are included.
- Carr, Donald E. Energy and the Earth Machine. New York, NY: W. W. Norton and Co., 1976, \$10. Many historical insights, examples of alternatives used abroad, and a strong chapter on conservation make this a book of general interest. "The Lost Art of Conservation" was also published as a magazine article in The Atlantic, Dec. 1975, pp. 59-70.
- Clark, Wilson. Energy for Survival: The Alternative to Extinction. Anchor Press/Doubleday and Co., New York, NY 1975. \$4.95. One of the most extensive overviews of the social, environmental, and economic aspects of energy, this is the nearest thing to an "energy encyclopedia." Senior high students and adults will appreciate its nontechnical explanations of conventional and renewable energy uses and discussions of social and economic implications of the energy transition. An extensive reference guide to other sources is included.
- Commoner, Barry. The Poverty of Power. New York, NY: Knopf, 1976, \$2.25. An environmentalist examines the links between use and misuse of energy, capital, and labor in this controversial book predicting that huge energy conglomerates will become extinct.
- Daniels, Farrington. Direct Use of the Sun's Energy. 1975 ed. Maryland: Ballantine Books, \$1.95. This is a comprehensive summary of low-cost solar applications and the research behind it. It's the best available introduction to solar technology.
- Eldridge, Frank. Wind Machines. National Science Foundation, Washington, DC, 1976, 78 pp., \$30. Best available overview on wind machines with photos, illustrations and diagrams. Describes history, potential, application performance and system design of wind machines.
- Fowler, John. Energy-Environment Source Book. National Science Teachers' Association, revised edition, 1978, \$5., 1742 Connecticut Ave., N.W., Washington, DC 20009. This is a compilation of basic facts and issues related to energy use and supply, with emphasis on fossil fuels. Quantitative information abounds in many tables and technical appendices. Math and physical science teachers may appreciate this one most but there is a sizable section on "Energy, Society, and Environment" for social science teachers as well.
- Gray, Elizabeth and Gray, David D. Growth and Its Implications for the Future. The Dinosaur Press, P.O. Box 666, Branford, CT 06405, 1975,

\$3. Social, ethical, and physical constraints on growth of energy use, resource consumption, pollution, population, food production and land use are discussed in a question-and-answer format accompanied by numerous cartoons. Good selected reading.

- Halacy, D. S., Jr. Wind, Sun, and Water: Our Energy Alternatives. Harper and Row, Inc., 10 E. 53rd St., New York, NY 10022, 1977, 192 pp., \$9.95. Easily read. The renewable resources of geothermal, water, tidal, sea thermal energy, wind, biofuels, and solar energy are presented for consideration.
- Hayes, Denis. Energy: The Case for Conservation. 1976, Worldwatch Institute, 1776 Massachusetts Ave., N.W., Washington, DC 20036, \$2, for a single copy. Ask for quantity discounts. This mini-book is crammed full of energy-conserving strategies as well as a strong rationale for their use. All segments of U.S. consumption are covered. For senior high students and adults.
- Hayes, Denis. Energy: The Solar Prospect. Worldwatch Institute, 1776 Massachusetts Ave., N.W., Washington, DC 20036, \$2. This is an excellent, detailed summary of windpower, waterpower, biomass, and direct sunlight resources and their applications now and in the future. Recommended for teachers.
- Hayes, Denis. Rays of Hope: The Transition to a Post-Petroleum World. W. W. Norton and Co., New York, NY, 1977, \$3.95 (ppbk). Technological, economic, and social problems of fossil fuels versus solar are presented, with solar emerging the winner. This is a very persuasive argument for using renewable energy sources, and it includes much information on applications of alternative technologies.
- Hodges, L. and Neff, J. Solar Energy 1976. Report from the Iowa Energy Policy Council, Lucas Bldg., Capitol Complex, Des Moines, IA 50319. This report is interesting reading. It describes some practical applications of solar technology in Iowa.
- Lemish, J. Mineral Deposits of Iowa. Iowa Southern Utilities Co. and Craftsman Press, Burlington, 1969. Excellent resource on local mineral deposits and their potentials, this one should be on every teacher's shelf.
- Lovins, Amory B. Soft Energy Paths: Toward a Durable Peace. Ballinger Pub. Co., 17 Dunster St., Harvard Square, Cambridge, MA 02138, 1977, \$6.95. This insightful and controversial book presents alternatives to current patterns of energy excesses and waste. Changes in decisions on how to obtain and use energy are advised as prelude to a safe, agreeable future. Information on costs and commentary on values clarify the "soft path" position. For adults.
- Lovins, Amory B. World Energy Strategies. Ballinger Pub. Co., 17 Dunster St., Harvard Square, Cambridge, MA 02138, 1975, \$4.95. This is a basic source of facts, issues, and options that should be read by anyone seriously interested in the energy debate and decision-making. Choices among energy sources are presented in an understandable

but technical manner. The type of society we'll have in the future, however, depends on how much energy we think we need. Recommended for teachers.

Lovins, Armory B. and Price, John. Non-Nuclear Futures. Ballinger Pub. Co., 17 Dunster St., Harvard Square, Cambridge, MA 02138, 1975, \$5.95. This influential work outlines concisely the main technical grounds for ethical, social, and economic concern about nuclear power in a way understandable to most people without technical training.

Lucas, Ted. How to Use Solar Energy in Your Home and Business. Ward Ritchie Press, Pasadena, CA, \$8. Includes solar heating and cooling, electric cars, and wind systems.

Mazria, Edward. The Passive Solar Energy Book. Rodale Press, Emmaus, PA, 1979, \$10.95. This comprehensive volume is two books in one. It is a primer on the fundamental concepts of heat transfer by solar energy and on its practical applications illustrated by photographs and performance data of many passive solar buildings. It is also a workbook containing step-by-step instructions on designing and sizing passive solar heating systems and how to calculate heat losses and gains, performance measures, and cost effectiveness. Excellent graphics support the clear, nontechnical language of the text. Yet there is plenty of data and basic formulae to provide practical assistance to the physical science or industrial arts teachers who want to know more of the how and why of solar energy transfer and storage.

Merrill, Richard and Gage, Thomas, eds. Energy Primer. New York: Dell Publishing Co., 1978, \$7.95. This updated sourcebook is a catalog of information and sources of plans and materials for use of renewable forms of energy--sun, wind, water, and biofuels. Emphasis is on homes and small-scale systems suitable for families or small communities. Many illustrations and concise factual reports sprinkled throughout. The large-scale paperback format invites student browsing. Suggestions for items to build are numerous.

Murray R. Nuclear Energy: An Introduction to the Concepts, Systems, and Applications of Nuclear Processes. 1975, Pergamon Press, Elmsford, NY 10523, \$14.50. Text cited as one of the most popular reference materials used by science teachers in North Carolina.

Pierotti, A., Keeler, A., and Fritsch, A. Energy and Food. revised, 1977, available for \$6.90 from Citizens' Energy Project, 1110 - 6th St., N.W., #300, Washington, DC 20001. The authors outline energy used in production, processing, delivery, and marketing of selected food items and suggest some ways to reduce this consumption. Energy "costs" of beverages and some other common processed foods are specified.

Rothchild, John and Tenney, Frank. The Home Energy Guide: How to Cut Your Utility Bills. New York: Ballantine Books, 1978, \$1.98. This is a very readable and portable paperback full of practical suggestions. A bargain!

Schmidt, F. H. and Bodansky, David. The Energy Controversy: The Fight Over Nuclear Power. 1976, Albion Pub. Co., 1736 Stockton St., San Francisco, CA 94133, \$7.95 (\$4.95 ppbk). This has been a very popular reference work for science teachers.

Stobaugh, R. and Yergin, D. Energy Future, Report of the Energy Project at the Harvard Business School. Random House Inc., 201 E. 50th St., New York, NY 10022, 1979, \$12.95. Considering the limited prospects of other energy strategies, the authors argue for solar energy and conservation. Further, they advocate decentralized power as requiring less capital investment and producing quicker results. Comprehensive and highly readable.

Wilson, Mitchell. Energy. rev. ed. Life Science Library, Morristown, NJ: Time-Life Books, 1970, \$7.95. This volume of the Life Science Library is a comprehensive, heavily illustrated book which examines energy from Galileo's discoveries to the laser beam. Sources of energy, measurement of energy, and each form of energy are discussed with the clarity typical of this series. One picture essay surveys the history and production of oil; other essays cover electrical phenomena, the power of the atom, and future power sources. A chronology recounts the history of atomic energy.

BOOKLETS

ABC's of Radiation. 1977. It is a free, 28-page booklet available to individuals sending a request to Public Affairs, Brookhaven National Laboratory, Associated Universities, Inc., Upton, NY 11973. This is clearly presented basic information about radiation from radioactive materials and nuclear reactors: definitions, measurements, risks, safety practices, and controls. Originally written for employees of a large laboratory using nuclear energy. The reading level is appropriate for advanced upper elementary students.

Basics of Solar Air Systems. It is from the Sheet Metal and Air Conditioning Industry, 1900 L St., NW, Suite 405, Washington, DC 20036. No charge. Elementary description of solar air systems, well illustrated.

Colder . . . Darker (analysis of FEA-sponsored National Survey of Household Energy Use) and Save Energy, Save Money (inexpensive conservation, insulation techniques) booklets available free from: Community Services Administration, Office of Energy Program, 1200 - 19th St., N.W., Washington, DC 20506.

Cooperative Extension, New York State, Save Energy, Save Dollars, available for \$1.50 from Mailing Room, 7 Research Park, Cornell University, Ithaca, NY 14853. This collection of articles offers practical advice to homeowners, prospective homeowners, and consumers on ways to conserve energy in daily living.

Department of Energy (DOE) energy education materials are available free of charge from: U.S. Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Ask for current list of

their many titles. Order in advance; two months waiting time for delivery is typical. Some representative titles are:

Careers in Energy Industries
Energy in Focus: Basic Data
The First Reactor
Flywheels: Storing Energy as Motion
Gas Mileage Guide for New Car Buyers
How to Save Money by Insulating Your Home
How to Understand Your Utility Bill
Nuclear Energy
Nuclear Power in Space
Nuclear Power Plant Safety
Sixty-Five Ways to Save Natural Gas
Solar Energy for Heating and Cooling
Tips for Energy Savers
Tips for the Motorist: Don't Be Fuelish

Department of Housing and Urban Development. In the Bank or Up the Chimney, U.S. Government Printing Office, Washington, DC 20402, Stock No. 023-000-00297-3, \$1.70. This booklet is an elaborate worksheet that allows homeowners to compute costs and benefits of storm windows, insulation, weatherstripping, and other energy-saving practices. It requires 2-3 hours to complete, but provides much worthwhile information and exercises math skills at the same time.

Department of the Interior, Geological Survey. Natural Steam for Power is an illustrated fold-out brochure on one kind of geothermal power. Cost: 25¢ from U.S. Government Printing Office, Washington, DC 20402, Stock No. GPO-19740-548-685.

D.P.I., Energy Conservation in School Facilities. Iowa State Department of Public Instruction, Grimes State Office Bldg., Des Moines, Iowa 50319. Brochure lists specific recommendations for reducing energy waste in school buildings.

Eaton, William W. Energy Technology, Energy Storage, Geothermal Energy, Oil, and Solar Energy are all available free from DOE, Technical Information Center, Box 62, Oak Ridge, TN 37830. Multiple copies for classroom use will be mailed on request. Ask for a current listing of other free publications on a wide range of energy topics.

Edelson, Edward. Alternate Energy Sources is one of many useful free booklets provided to teachers by Edison Electric Institute, 90 Park Avenue, New York, NY 10016.

Energy, A Growing National Problem. Education Servicing Section, National Wildlife Federation, 1412 Sixteenth St., NW, Washington, DC 20036. Single copy free; additional 20¢ each; 50 or more, 16¢ each. The illustrated, 16-page report discusses our energy problem and solutions.

The Good News About Energy is a 49-page report of a 1979 study by the Council on Environmental Quality. It is available from the Executive Office of the President, Council on Environmental Quality, 722 Jackson Place, N.W., Washington, DC 20006. The potential for achieving lower energy growth in the United States and the implications for the economy, the environment, and government policy are discussed.

How to Save Gasoline . . . and Money is an 8-page pamphlet on efficient driving practices. Available free from DOE Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Ask for a list of currently available publications on energy-related topics.

Iowa Energy Policy Council. Home Energy Savings Manual is a well-written booklet that provides basic energy conservation measures for the home. It has about 75 pp. and is free. It is available from the Iowa Energy Policy Council, Capitol Complex, Des Moines, IA 50319.

Iowa Power. A series of "Q and A" booklets were developed using a format of questions and answers to discuss the content. Titles are: Gas Safety, Gas Supply, Utility Regulation, Electric Safety, Electric Supply and Profit. Each booklet is about 5 pages in length and is available to customers in the Iowa Power and Light service area in central and southwest Iowa through the local utility office.

Miller, Alan S., et al. Solar Access and Land Use: State of the Law 1977, free, from the National Solar Heating and Cooling Information Center, P.O. Box 1607, Rockville, MD 20850. This is a summary of solar access rights for various buildings depending on solar input for comfort and is part of a larger study, Legal Barriers to Solar Heating and Cooling of Buildings.

Olin, Hubert L. Coal Mining in Iowa, State Mining Board, State of Iowa, Des Moines, Iowa 50319. Early history of coal mining in Iowa and role of coal in development of the state's economy are presented.

Solar Energy - Progress and Promise. Executive Office of the President, Council on Environmental Quality, 722 Jackson Place, NW, Washington, DC 20006. The 42-page booklet discusses progress in the development of various aspects of solar energy utilization.

Your Energy World. Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. This 1977 publication is for grades 4-6 and is free.

TEACHER AIDS

American Gas Association, 1515 Wilson Blvd., Arlington, VA 22209, will send teachers free copies of their educational services newsletter, Natural Gas Energy. Reading level is adult. Each issue focuses on one topic. For example, Volume 8, No. 2 is devoted to "Fuels from Biomass." Other recent issues centered on "Synthetic Natural Gas from Peat," "Coal Gasification," "Natural Gas and the Environment," "Energy Balances." Free kits are available such as: Natural Gas Serves Our Community Kit for grades 4-5 or grades 2-3. A booklet is also offered by the title Natural Gas Serves Our Community Booklet for grades 2-3 or 4-5. Additional free booklets are:

Natural Gas - Science Behind Your Burner
Experiments: Properties of Gas and Heat Energy

How Your Gas Meter Works
Look to the Future - The Gas Company in Your Community
History of Natural Gas
The Story of Natural Gas Energy

Carey, Helen. Award Winning Energy Education Activities for Elementary and High School Teachers. 1977, available at no cost from DOE Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830.

CEL Blocks. Primary Interdisciplinary Environmental Learning Packets, Brevard County, FL. (ESEA Title III, Project #050-2323-73003). Student cards covering areas of environmental education which can be used by teachers in a variety of interdisciplinary ways.

Community Workers and the Energy They Use. National Science Teachers Association, (grade two), 1976, free. Available from DOE Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830.

Curriculum for Appropriate Technology. National Center for Appropriate Technology, P.O. Box 3838, Butte, MT 59701. \$5. The packet includes a selection of ten activities about present and future energy systems. Topics covered are: Energy Production and Use, Food and Nutrition, Renewable Resources, plus Cans and Recycling. Posters, handouts, and learning games are included.

Education Packets: Wind Conservation, Solar and Chemical Energy. Simple and well described projects are suggested for upper elementary students. Obtain from: American Museum of Atomic Energy, P.O. Box 117, Oak Ridge, TN 37830.

Edison Experiments You Can Do is available for 50¢ from the Charles Edison Fund, David O. Schantz, Curator, 101 South Harrison Street, East Orange, NJ 07018. This is a collection of seven booklets describing 75 experiments related to concepts of electricity. Alternative Energy Sources, Energy Conservation, Nuclear Experiments, and Environmental Experiments are among the topics included.

Energy. Environmental Education Project, ESEA Title III, Section 306 Topeka Public and Parochial Schools, 1601 Van Buren, Topeka, KS 66612 (ED 093 649). Objectives are listed, along with activities which meet the stated objectives. Teachers select only those appropriate to the objectives for their students.

Energy. Michigan United Conservation Clubs, P.O. Box 30235, Lansing, MI 48909. Provides information on the nature of energy, sources and uses of energy, and conservation. There are also some work sheets and ideas for helping others learn more about energy.

Energy. Social Issues Resource Series, Eleanor C. Goldstein, 1975. Social Issues Resource Series, Inc., 1200 Quince Orchard Boulevard, Gaithersburg, MD 20760. Notebook filled with reprints of articles related to energy.

Energy Activities for the Classroom - 1976. Coon, Herbert L. and Michele Y. Alexander, 1976. ERIC Center for Science, Mathematics and Environmental Education College of Education, the Ohio State University, 1200 Chambers Road, Third Floor, Columbus, Ohio 43212. Resource booklet of energy teaching activities divided into grade levels: K-3, 4-6, 7-9, 10-12.

Energy Conservation Classroom Kits 1-3, 4-6. Southern California Edison Company, 1976. Educational Services, Room 397, P.O. Box 800, Rosemead, CA 91770. Colorful kits to help teachers teach about energy conservation. There are folders, inspector cards, stickers, certificates. The teacher's guide contains ideas and lesson plans, in addition to duplicating masters.

Energy Crisis Teaching Resources. Curry, Wendell, et. al., Oregon State Board of Education, Salem, OR, 1973, 59 pp. (ED 085 316). Many very useful activities to be used in stressing individual responsibility towards energy crisis problems.

The Energy Crisis: What You Can Do About It. Standard Oil Company (Indiana), 1973. Mail Code 3705, 200 E. Randolph Drive, Chicago, IL 60601. Folder containing four spirit masters and specific teaching instructions. The spirit masters give information and ask for students to supply some interpretation. Parents and other adults are encouraged to participate.

Energy Education Activities for Elementary and High School Teachers. National Science Teacher Association, 1724 Connecticut Ave., NW, Washington, DC 20036. 1978, Free.

Energy - Environment Materials Guide. Mervine, Kathryn E. and Rebecca E. Cawley, National Science Teachers Association, Washington, DC, 1975, (ED 111 663). Handy source book containing annotated bibliographies for teachers, students. Non-print material.

Energy - Environment Mini-Unit Guide. Smith, Stephen M., ed., 1975. National Science Teachers Association, Washington, DC, (ED 111 664). Materials designed to stimulate decision making in young children and to make teaching more interdisciplinary. It is filled with many activities and guidelines.

Energy and Man's Environment. Jones, John, D.Ed., Editor, 1976. Energy and Man's Environment, Inc., 0224 S.W. Hamilton, Suite 301, Portland, OR 97201. Interdisciplinary teacher's guides to energy and environmental activities. Involves 8 books - Activity Guide, Uses of Energy, Sources of Energy, Impacts of Energy, Limits of Energy, Conversion of Energy, Future Sources of Energy, Glossary.

Energy and Man's Environment - Activity Guide. Ris, Thomas F. Energy and Man's Environment, 2121 Fifth Avenue, Seattle, WA 98121, (ED 106 070). Provides educational strategies and materials needed for introducing energy to all grade levels on an interdisciplinary basis. Each chapter has four themes: (1) Scientific, (2) Ethical, (3) Aesthetic, (4) Utilitarian.

Energy for Today and Tomorrow. San Diego City/County Schools Energy Education Committee Department of Education, San Diego County, 6401 Linda Vista Road, San Diego, CA 92111, 1975. Activities for students in grades kindergarten through six. These help to create an awareness of the need of dealing with energy problems.

Energy is Basic is a free information pack from the Energy Action Office, Westinghouse Nuclear Fuel Division, P.O. Drawer R, Columbia, SC 29250.

The Energy Show. The New Western Energy Show, 226 Power Block, Helena, MT 59601. It is a script for a puppet or acting show. \$3.50.

The Energy We Use. National Science Teachers Association, (grade one), 1976, free. Available from DOE Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830.

Environmental Education: Strategies for Wise Use of Energy. Division of Science Education, North Carolina Department of Public Instruction, Raleigh, NC 27611, c. 1974. Designed for use at all grade levels, therefore, activities are grouped K-3, 4-6, 7-12. An appendix contains charts, glossary, bibliography, checklists.

Get Your Hands on Energy. The New Western Energy Show, 226 Power Block, Helena, MT 59601. A collection of simple, practical, "hands on" projects deals with energy concepts. \$3.50.

Living Within Our Means: Energy and Scarcity. Environmental Educational Instructional Activities K-6, The University of the State of New York, The State Education Department, Albany, NY 12234. Instructional manual which illustrates ways in which environmental concerns may be integrated into the curriculum. Excellent activities arranged according to disciplines.

Mickey Mouse and Goofy Explore Energy. Walt Disney Productions, 1976. Public Affairs Department, EXXON, U.S.A., P.O. Box 2180, Houston, TX 77001. Very comprehensive, yet delightfully presented energy comic book. Copies are available from the above address. Covers previous sources of energy and possible future sources.

Nineteen Fact Sheets On Alternative Energy Sources. (1977) Sheets include wind; bioconversion; solar, ocean, geothermal, and nuclear power; coal-derived fuels; conservation; energy storage; environmental impacts; a glossary and a bibliography are also results of NSTA/DOE cooperation. The sheets are available from the Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. The materials were prepared by the National Science Teachers' Association.

North Carolina DPI, The Energy Conserver, available on request from the Division of Science Education, Room 284 Education Building, Raleigh, NC 27611, is a monthly newsletter full of tips on energy and schools, conservation projects, and classroom activities.

Student Learning Activity Module "The Energy Crisis". Hughes, Judi and Lee County Environmental Education Program, Title III ESEA, 2266 Second Street, Fort Myers, FL. Contains lesson plans, resource

materials, and a Student Teaching Module on energy. Developed to help create an awareness of the causes, and some solutions for the energy crisis the world is facing.

A Teacher's Guide For Energy Conservation. Contact: Jonathan Wert, Environmental Center, University of Tennessee, South Stadium Hall, Knoxville, TN 37916.

A Teacher's Handbook on Energy. Interstate Energy Leadership Project, Colorado Department of Education, 201 E. Colfax Ave., Denver, CO 80203.

Ways to Environmental Education; Volume III, Allen, Rodney F., Ed. and Others. Florida State University, Tallahassee College of Education, Tallahassee Junior Museum, FL, 1975, 150 pp. Ten environmental booklets in one volume. One booklet covers energy learning activities for camp and home.

Wide World of Energy Kit. Walt Disney Productions, 1976, Walt Disney Educational Media Company, 500 South Buena Vista Street, Burbank, CA 91521. Kit contains cassette and color filmstrip titled, "The Search for Power and Energy;" 18 full-color study prints; Energy Game; 30 copies of the energy comic book, "Mickey Mouse and Goofy Explore Energy;" 10 energy activity cards; teacher's guide with information and additional activities.

PERIODICALS

ALTERNATIVE SOURCES OF ENERGY features articles on many aspects of alternative technologies and is a clearinghouse for practical ideas on energy sources. Bi-monthly, \$10/yr. from Alternative Sources of Energy, Inc., Route 2, Box 90A, M'Alaca, MN 56353.

CURRENTS is a survey of solar legislation, research, workshops, and alternative energy issues in Iowa. Published by Citizens United for Responsible Energy, 3500 Kingman Blvd., Des Moines, IA 50311 at \$5/year.

EARTH JOURNAL, published quarterly, regularly features energy-related subjects. Costs \$3/yr. from Minnesota Geographic Society, P.O. Box 6181, Minnehaha Sta., Minneapolis, MN 55406.

ENERGY AND EDUCATION, a bi-monthly newsletter is available free from NSTA, 1724 Connecticut Ave. NW, Washington, DC 20036. It features energy facts and news of educational programs across the country.

FREE ENVIRONMENT NEWSBRIEFS. Published eight times per year by Free Environment, Inc., Activities Center, Iowa Memorial Union, Iowa City, IA 52242 - \$2. Deals with all types of environmental issues.

IOWA ENERGY BULLETIN. Published monthly by Iowa Energy Policy Council, 215 East 7th Street, Des Moines, IA 50319 - no charge. A survey of Iowa energy and conservation issues.

IOWA SCIENCE TEACHERS' JOURNAL, a quarterly, is available free to science teachers requesting it on the school letterhead, c/o Managing Editor, ISTJ, Iowa Academy of Science, University of Northern Iowa, Cedar Falls, IA 50613. Volume 16, No. 1 (April 1979) focused on energy, with Iowa-specific information.

MOTHER EARTH NEWS is romantically "back to the land." It has interesting articles on unusual homes, low-energy life styles, recycling and bartering, "do-it-yourself" everything.

PEOPLE AND ENERGY is published monthly by Citizens Energy Project, 1413 K Street NW, 8th Floor, Washington, DC 20005, \$10. News of citizen action on energy and appropriate technology.

SCIENCE NEWS has weekly articles on energy research and technology.

MULTI-MEDIA MATERIALS

16 mm films, filmstrips, video cassettes and posters: The following items are a small, selected sample of the materials available on ENERGY.

For a broader listing of resources available to you at low or no-cost, contact your AEA, the media center of the nearest university, and the organizations listed in this publication. Also recommended is an excellent film bibliography, bound for library use and arranged by topics (What is Energy? Energy Issues and Options, Energy and the Environment, Energy Conservation, Sources of Energy). It is available at cost, \$3, from New York State Alliance to Save Energy, 36 W. 44th Street, Room 709, New York, NY 10036. Ask for Energy on Film.

Filmstrips referred to in the ECAP's can be borrowed from your local AEA. In 1978, the AEA's received five sets of filmstrips. Some may have been sold to individual districts. Contact the DPI Energy Consultant if you are unable to locate a filmstrip through the AEA media center.

THE AMERICAN DREAM IS RUNNING OUT OF FUEL. 18 minutes, color, \$230 or \$19-rent (grades 5-8). Films, Inc., 1144 Wilmette Avenue, Wilmette, IL 60091.

American Gas Association, Dept. I-14, 1515 Wilson Blvd., Arlington, VA 22209, furnishes free 35 mm filmstrips. NATURAL GAS--SCIENCE BEHIND YOUR BURNER shows how gas gets from well to burner and comes with wall charts and worksheets. Other titles include, FUEL CELLS, HOW THE JET ENGINE WORKS, LOOK TO THE FUTURE, MORE TO COME (estimates of energy resources underground), SCIENTISTS WORK TOGETHER (case study of a fuel cell research project). Free films for teachers are available from the same source. ENERGY traces sources from the first fires to atomic power, outlines problems and proposes some solutions.

Association Films, Inc., 866 Third Avenue, New York, NY 10022 lends 16 mm movies free of charge. Examples of titles are MIRRORS OF TIME about a research ship exploring the ocean floor in search of gas and oil deposits; THE ENERGY BRIDGE about coal's potential to bridge the fuel resource gap; KING ZOB AND THE ENERGY CRUNCH about space heating and cooling conservation possibilities; UNSEEN JOURNEY about transporting crude petroleum.

BATE'S CAR: SWEET AS A NUT. 16 minutes, 16 mm, color, \$230 or \$30-rent, 1975 (grades 5-12). Arthur Mokin Productions, 17 W. 60th Street, New York, NY 10023. Presents the inventor's energy-saving inventions, particularly his methane-driven automobile. Highly recommended by AAAS.

COALMINING: THE STORY OF BURIED SUNLIGHT. Filmstrip #1, Part A, elementary, grade 5. Available through the local AEA.

Citizens' Energy Project, COMMUNITY SELF-RELIANCE POSTER, 1979, \$4, from Citizens' Energy Project, 1413 K Street, 8th Floor, Washington, DC 20005. This colorful graphic displays a self-reliant community basking under the sun. Rehabilitated homes, bike paths, urban gardens, greenhouses, and a community health clinic are featured projects. Flip side lists resource people and other information.

CONSERVE YOUR ENERGY, a family energy diet kit (includes booklet, score card, poster) is available for \$2 from Associated Press, 50 Rockefeller Plaza, New York, NY 10020.

C.U.R.E. (Citizens United for Responsible Energy) produced SOLAR ENERGY IN IOWA, a 22-minute slide show in 1977 which covers the basic principles of solar as well as projects in and near Iowa. A cassette and script is included. Rental for contribution from C.U.R.E., 3500 Kingman Blvd., Des Moines, IA 50312. 515/277-0253.

DOE Technical Information Center Film Library, P.O. Box 62, Oak Ridge, TN 37830, provides teachers with an annotated brochure on free energy films for classroom use. Write for your copy. Some titles that Iowa teachers have used and liked are LOOK TO THE SUN; SUN POWER FOR FARMS; THE ULTIMATE ENERGY and TO BOTTLE THE SUN (on fusion's potential); PUTTING THE SUN TO WORK (showing an innovative home); ENERGY, THE AMERICAN EXPERIENCE (which illustrates the historical relationship between economic growth, industry, and energy sources); CHALLENGE OF THE FUTURE; ON THE MOVE (about packing and shipping radioactive materials); POWER FROM THE EARTH (concerning geothermal energy); UP THE POWER CURVE, on conservation, covers a wide range of energy-saving ideas and estimates and savings from each; WORLD BEHIND YOUR LIGHT SWITCH tells in a non-technical way the story of production, transmission, and use of electricity.

ECOLOGY ACTIVITY CARDS are available from: BFA Educational Media, 2211 Michigan Avenue, Santa Monica, CA 90404. Some of the activities are related specifically to energy. Others in the box guide the children towards conservation and the idea of using our resources wisely.

ECOLOGY: UNDERSTANDING THE CRISIS is available from: Series No. 6454, c. 1972. Encyclopedia Britannica Educational Corporation, 425 North Michigan Avenue, Chicago, IL 60611. Filmstrip, records, guides generally cover what has caused the crisis, how man relates to his environment, plus a look into the future.

ENERGY: A FIRST FILM. 8 minutes, sound, color (grades K-3), BFA Educational Media, 2211 Michigan Avenue, Santa Monica, CA 90404.

ENERGY: ABILITY TO DO WORK. 9 minutes, color, sound (grades 5-8), AIMS Instructional Media Service, P.O. Box 1010, Hollywood, CA 90028.

ENERGY ALTERNATIVE OR FUTURE SOURCES OF ENERGY. Filmstrip #2, elementary grade 6. Available through the local AEA.

ENERGY AND ITS FORMS. U 25547, CORF-1961, 11 min. b/w, \$5.60. Explains the basic concept of energy and shows examples of its principal forms, including nuclear energy. Introduces the idea of changing energy from one form to another to do work, and outlines the way in which plants convert the energy of the sun to chemical energy to provide a basic source of food and fuel. See "Iowa Films" listing for ordering information.

ENERGY AND WORK. US 25686, EBEC-1962, 11 min., color, \$6.80. Explains through simple experiments that energy is neither created nor destroyed, but simply changed from one form to another. Illustrates a variety of these transformations and explains them in simple terms. See "Iowa Films" listing for ordering information.

THE ENERGY CHALLENGE - Kit, c. 1975. Pollution Control Education Center, Township of Union Public Schools, Union, NJ. Grade level undesignated, however, could be used in grade 6 with some modification and for the junior high. Contains student booklets, teacher's guide, two filmstrips with cassette, duplicating masters, activity cards, and overhead transparencies.

ENERGY CRISIS. U 30217, JOU-1972, 12 min., color, \$8.30. Reviews our sources of energy and the length of time they may remain available. A hydro-electric plant, a conventional steamdrive electrical power plant and a nuclear power plant display how each generates power and its limitations. Concludes with possible solutions such as the "Fast Breeder Reactor" and "Fusion Reactor" which may someday provide unlimited power. See "Iowa Films" listing for ordering information.

ENERGY CRISIS GAME. 1973 (Upper elementary and junior high), Intemation, Inc., New York, NY 10001. For 2-6 players.

ENERGY DOES WORK. U 25548, CORF-1961, 11 min., b/w, \$5.60. Billy, surprised to learn that when he is playing, he is doing work, is shown, by means of examples intended to appeal to the young child, that work is done whenever something is moved, that energy can be stored, and that food supplies energy to our bodies. See "Iowa Films" listing for ordering information.

ENERGY GAME. Northern Natural Gas produced a twenty minute slide-tape show followed by a quiz, designed for grades 4-6. The stress is upon energy conservation with a short review of where energy comes from. The kit is available through Northern Natural Gas, 503 Shops Bldg., Des Moines, IA 50309. 515/288-7463. No charge.

ENERGY HISTORY OF THE UNITED STATES 1776-1976 is a large, colorful wall poster for classroom use. Cost: \$2.05 from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, Stock No. 062-010-00459-0.

ENERGY IN IOWA. Filmstrip #1, Part B, elementary grade 5. Available through the local AEA.

ENERGY: PAST AND PRESENT, and ENERGY: FUTURE SUPPLY AND COSTS are slide-tape sets available free from Iowa State Extension Service. Call the county extension office to borrow copies.

ENERGY WITH A CAPITAL C - FOR CONSERVATION. Energy Policy Council, 707 East Locust, Des Moines, IA 50319. Slide presentation comes complete with slides, audience pamphlets, and a recorded cassette of the slide narrative.

FIRST FILM ON THE WIND. 9 minutes, 16mm, color, sound, c. 1966, (Elementary), BFA Educational Media, 2211 Michigan Avenue, Santa Monica, CA 90404. Shows how, though one cannot see the wind, he can see what the wind does, such as making waves on the water, swaying trees, and lifting kites. Shows how rain clouds come and go with the wind.

Iowa Films. Films listed as "Iowa Films" can be ordered by phone, by mail, or in person. (Collect calls accepted from Iowa.) Ask for film scheduling. The two locations of film centers are:

University of Iowa
Media Library
C-5 East Hall
Iowa City, IA 52242
319/353-5885
Hours: 8:00-5:00

Iowa State University
Media Resources Center
121 Pearson Hall
Ames, IA 50011
515/294-1540
Hours 7:30-12:00
1:00-5:00

Price list is the charge for three day rental. You are responsible for return postage. A written purchase order is required before shipment from the media resource person or business office of your school.

Iowa Energy Extension Service has several audio-visual resources available on energy conservation for no charge except return postage. Order from: Iowa Energy Extension Service, Iowa State University, 110 Marston Hall, Ames, IA 50011.

Films:

* THE GREAT ADVENTURE

A 30-minute color sound 16 mm production showing the potential for solar energy, emphasizing a variety of applications including

wind and the making of fuels from biomass products. Eddie Albert narrates. 1979. For general use. Produced by Department of Energy.

* A CITY FARMSTEAD

15 min., 16 mm color. Shows how one urban house uses solar, waste recycling and food production.

Slide Shows:

* PASSIVE SOLAR ENERGY

Six separate slide shows of 20 slides each on the following topics: general, direct gain, conservation aspects, thermal storage walls, attached greenhouses, water heating and roof ponds. Pictures and projects mostly from New Mexico. Developed by Dr. J. D. Balcomb. Script included.

* THE SOLAR QUEST

87 slides, 11 minutes, color. Documents how solar is being tapped for practical use in homes. Includes underground. Produced by The Polished Apple. Also available in filmstrip. Cassette tape accompanies. For general use.

* ENERGY FOR RURAL IOWA

20 minutes. Discusses research projects at Iowa State University. #S851. Can be ordered through Media Resources. Includes wind, research house, alcohol, methane. Produced in 1979.

Living History Farms. SEEDS OF SURVIVAL, a 28-minute film portrays American farming of pioneers, and farmers in the 1900's and today. Energy reliance and sources are evident. The film is available for \$3 from: The Grinnell Mutual Reinsurance Company, Public Relations Department, Grinnell, Iowa 50112; or Living History Farms, R.R. 1, 2600 NW 111th St., Des Moines, IA 50322.

MAN'S SEARCH FOR ENERGY. Filmstrip, 36 frames, \$6.75, (grades 5-8), McGraw-Hill Films, 1220 Avenue of the Americas, New York, NY 10020.

Modern Talking Picture Service, 2323 Hyde Park Rd. New Hyde Park, NY 11042, offers a variety of free films produced by major industries as public relations/education efforts. Most of them are very professionally done; many are cinematic award winners. Write to the above address for their free lists. (Films are shipped from the Modern Library in Cedar Rapids.) A few of their other energy-centered movies available to junior and senior high schools are: WITHIN THIS EARTH, A MATTER OF ENERGY, MINING AND THE ENVIRONMENT, ENERGY VS. ECOLOGY, THE GREAT DEBATE, NUCLEAR ENERGY FOR TODAY AND TOMORROW, OFFSHORE, REFINERY, ENERGY IN PERSPECTIVE.

THE PETRIFIED RIVER. Film available from Iowa Electric Light Company.

RHR Filmedia, Inc., 1212 Avenue of the Americas, New York, NY 10036 will lend (free) the 16 mm color film, A QUESTION OF VALUES. This is the story of a small town's intense debate over potential benefits and dangers of a new oil refinery. Also, free on loan from the same source, THE HIDDEN ENERGY CRISIS explains that energy shortages may reduce supplies of petrochemicals commonly used in clothing, shelter, and food, and DOUBLE UP AMERICA explains benefits of carpooling.

Rienow, Robert. DARKNESS FOR OUR CITIES is an audiotaped plea for wasteful Americans to change their ways. It would be a useful introduction to an energy or conservation unit. Students will hear many possibilities for further research. Available for \$14.95 from Center for Cassette Studies, Inc., 8110 Webb Avenue, North Hollywood, CA 91605.

Shell Oil Company Film Library, 1433 Sablier Circle West Drive, Indianapolis, IN 46239 will send you a list of films available on free loan. Some energy-related offerings are: THE FOSSIL STORY which emphasizes significance of fossils in the search for oil deposits; THIS LAND which explores the natural resources of North America, including oil and coal, and how they were formed; OIL, OIL WELL, and REFINERY PROCESSES which depict the source and processing of American's favorite fuel; and FOOD OR FAMINE which illustrates methods of improving agriculture around the world.

Union Carbide Corporation, Public Affairs, 1730 Pennsylvania Avenue NW, Washington, DC 20006 will provide a free wall chart listing nearly 500 NON-FUEL USES FOR OIL.

U.S. Department of Commerce, Office of Energy Programs, Room 3011, Washington, DC 20230 will lend (free) the 16 mm color film on ENERGY: CRITICAL CHOICES AHEAD, a discussion of energy supply and demand through the year 2000.

ORGANIZATIONS AND RESOURCES

If you have the energy to write a few letters on school stationery, the following organizations will fill your mailbox with free or low-cost information on energy topics.

American Gas Association, 1515 Wilson Blvd., Arlington, VA 22209 has an energy newsletter, films, ditto masters, and a variety of free literature free to teachers who request them on school stationery.

American Petroleum Institute, Information Service Department, 2101 L Street NW, Washington, DC 20006 provides an abundance of colorful materials for classroom use, free on request, including movie loans.

American Public Gas Association, Watergate Office Bldg., 2600 Virginia Ave. NW, Washington, DC 20037 provides free educational materials on request.

American Wind Energy Association, 1621 Connecticut Avenue NW, Washington, DC 20009 will send a brochure of general information about windmills, an invitation to join the club, and a list of publications available on the subject of wind machines.

Area Education Agency (AEA) has films, filmstrips, book catalogs and other resources for energy education. Contact the nearest one.

Association of Home Appliance Manufacturers, 200 N. Wacker Drive, Chicago, IL 60606 provides free "Energy Data" on typical operational costs of home appliances.

Atomic Industrial Forum, Public Relations Department, 7101 Wisconsin Avenue, Bethesda, MD 20014 will send information on nuclear power plants, including black-and-white graphics (for easy reproduction) diagramming various types of reactors.

Chamber of Commerce may be able to help locate solar buildings, alternative energy-related businesses, knowledgeable members of the community who may cooperate on an energy project for the class.

Citizens' Energy Project, 1110 - 6th St., NW, #300, 8th floor, Washington, DC 20001 researches and publishes comprehensive, low-cost reports on dozens of energy resources. Write for current list of titles.

Citizens United for Responsible Energy (CURE) 3500 Kingman Blvd., Des Moines, IA 50311, Tel. 515/277-0253, maintains a roster of speakers on energy topics and publishes a newsletter that often features "solar successes."

Cooperative Extension Service, 110 Curtis Hall, Iowa State University, Ames, IA 50011 has many bulletins and pamphlets on energy conservation available for the asking. Write or call 515/294-4576.

Edison Electric Institute, Public Relations Department, 90 Park Avenue, New York, NY 10016, provides information on all forms of electrical generation and a series of useful handbooks of energy-related experiments for the classroom.

Energy and Education Action Center, Room 514, Reporters Building, 300-7th St. SW, Washington, DC 20202, serves as an information center and data distribution network centered on energy-education materials and conservation measures.

Energy Extension Service, 110 Marston Hall, Iowa State University, Ames, IA 50011, has information and programs for schools and communities. Write or call 515/294-4266 for an up-to-date list of services.

Energy Research and Information Foundation, 3500 Kingman Blvd., Des Moines, IA 50311. ERIF is a non-profit corporation to promote and conduct research and educational projects as well as to provide information. Programs include Energy Sources, Kill-A-Watt, and a Traveling Solar Display. Phone: 515/277-0968.

Environmental Action Foundation, The Dupont Circle Bldg., Suite 724, Washington, DC 20036 will send a resource guide on electric utility issues.

Environmentalists for Full Employment, 1101 Vermont Ave N.W. #305, Washington, DC 20005 has published Jobs and Energy (\$2 for individuals) and Jobs and Energy Update (50 cents each), exploring the impact of energy use transitions and alternative energy sources on employment. They advocate conservation and diverse solar systems as the best answers to the related problems of unemployment and the capital drain made by corporate energy industries.

Ethyl Corporation produces an annual Ethyl Digest on an energy topic. Get a free copy by writing to Ethyl, Corporate Public Relations, 330 South Fourth St., Richmond, VA 23217.

Ideas and Information Center, Iowa-Illinois Gas and Electric Company, 1403 Kimberly Road, Bettendorf, IA 52722. Phone 319/326-7054. Educational materials and answers to specific questions on local utility rates, consumption patterns, and insulation guidelines.

Institute for Local Self-Reliance, 1717 - 18th St. NW, Washington, DC 20009. This non-profit educational and research group explores possibilities of urban communities becoming productive, self-reliant systems. Write for their list of publications on topics like "A Neighborhood Energy/Food/Waste System," "Dawning of Solar Cells," "Neighborhood Power," and various food production concerns.

International Solar Energy Society, American Section, 12441 Parklawn Drive, Rockville, MD 20852 maintains a bibliography of solar and other renewable energy sources.

Iowa Academy of Science, University of Northern Iowa, Cedar Falls, IA 50613 publishes the quarterly Iowa Science Teachers Journal.

The April 1979 issue featured several energy-education articles including "Wind Energy in Iowa." This one issue is available free to science teachers using school stationery for their request to the Editor, ISTJ. Subscription rate is \$4/year.

Iowa Center for Local Self-Reliance, 3500 Kingman Blvd., Des Moines, IA 50311. The center is trying to research, demonstrate and educate the public about technologies and social structures which lead to self-reliance such as solar energy, energy conservation, organic gardening, recycling, and water conservation. Demonstrations, pamphlets, programs and consultations are offered. Phone: 515/277-0968.

Iowa Energy Policy Council, Lucas Bldg., Capitol Complex, Des Moines, IA 50319 has up-to-date information on energy use in Iowa and booklets on a variety of energy topics. Hotline: 515/281-4306.

Iowa Solar Office, Iowa Energy Policy Council, Capitol Complex, Des Moines, IA 50319 has solar energy information and materials including publications, films, a speakers bureau, consumer materials and lists of Iowa solar businesses and architects. Phone: 800/532-1114.

Iowa Solar Energy Association, 1433 Wildwood Drive, Cedar Rapids, IA 52402, 319/365-6103 may be able to provide you with resource persons who are knowledgeable about solar technology.

League of American Wheelman, 19 S. Bothwell, Palatine, IL 60067 provides information on ways and means of improving conditions for bicycling.

League of Women Voters of the United States, 1730 M Street NW, Washington, DC 20036 has a catalog of their own free or low-cost energy publications. Revised annually, this catalog is available from "Energy Department Publications" at the above address.

National Coal Association, 1130 Seventeenth Street NW, Washington, DC 20036, has articles, booklets, films, and other aids available on request that discuss the past, present, and future of coal.

National LP-Gas Association, 1800 North Kent St., Suite 1004, Arlington, VA 22209, provides free information about their products.

National Petroleum Council, Director of Information, 1625 K Street NW, Suite 601, Washington, DC 20006, provides free literature on various aspects of getting and using petroleum.

National Science Teachers Association, 1724 Connecticut Ave., NW, Washington, DC 20036 will send any teacher their bimonthly newsletter Energy and Education (free) plus a list of other energy publications.

National Solar Heating and Cooling Information Center, P.O. Box 1607, Rockville, MD 20850 publishes many handsome no-cost brochures and books, like "Passive Design Ideas for the Energy Conscious Consumer." You can call this group toll-free at (800) 523-2929.

National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161 sells reprints of many otherwise-difficult-to-locate publications on a wide variety of energy topics. Write for a free list of publications.

National Wildlife Federation, 1412 - 16th St. NW, Washington, DC 20036 has conservation education publications and selected resource materials for developing energy education programs.

Public Interest Research Group, P.O. Box 19312, Washington, DC 20036 can provide information on Energy Alternatives.

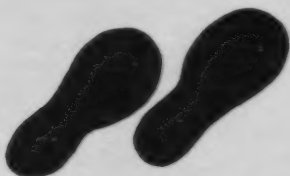
Shell Educational Services, Shell Oil Company, P.O. Box 2463, Room 1541, One Shell Plaza, Houston, TX 77001 can provide energy education materials.

Sierra Club, Information Services, 1050 Mills Tower, San Francisco, CA 94104 will provide an Energy Packet for \$1. This collection of articles includes "Solar Energy Now," and "Geothermal Energy" among several others.

U.S. Government Printing Office, Washington, DC 20402, offers many energy-related publications at prices from \$1 to \$10. Write to the above address and ask for Subject Bibliography Index and Price List 36 which contain information for selecting materials pertinent to energy-environmental issues.

Utility and/or Power Companies often have pamphlets and filmstrips, and sometimes posters, games, and lesson plans available to teachers.

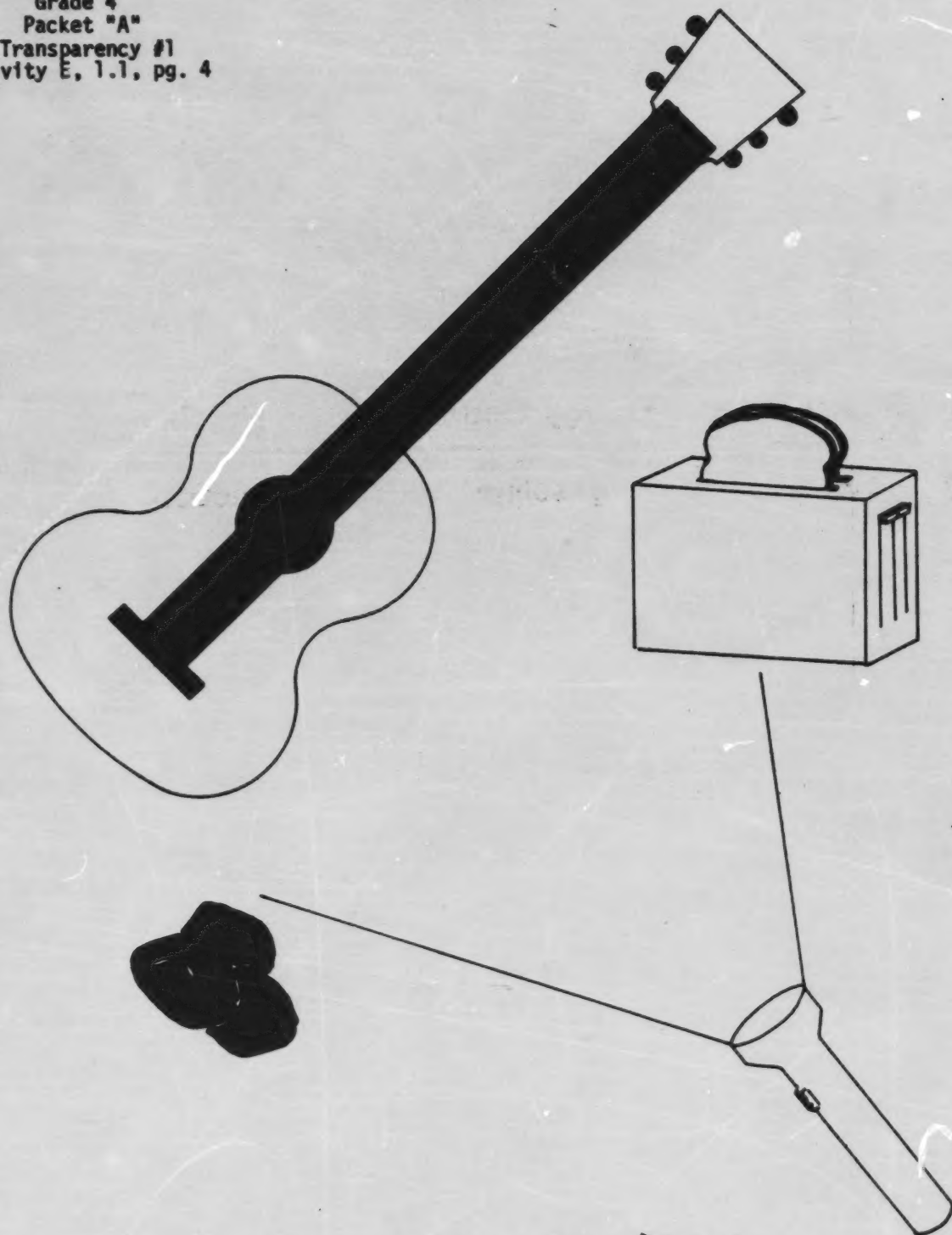
Volunteers in Technical Assistance (VITA), 3706 Rhode Island Ave., Mt. Rainier, MD 20822 publishes technical bulletins on do-it-yourself technology including solar, hydro, and wind-powered projects. Bulletins are well illustrated, clearly written, and range in price from \$1 to \$6. Write for a free list of titles.



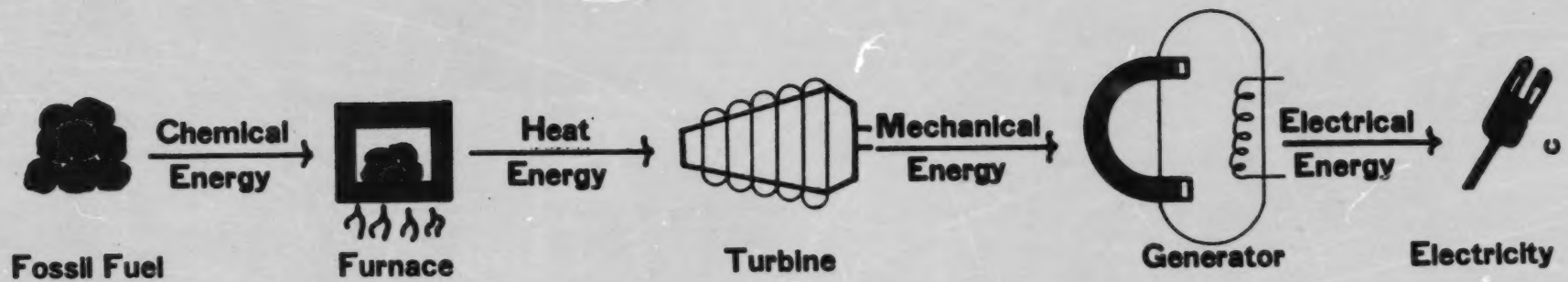
WALK TO FIND ENERGY

	Object	Energy Source	Product
(example)	car	gasoline	motion

Energy Activities
Grade 4
Packet "A"
Transparency #1
Activity E, 1.1, pg. 4



STEAM GENERATING PLANT



ENERGY STEPS



a bear gets up and walks there

a bear needs to go somewhere

WHEN A BEAR NEEDS TO GO SOMEWHERE



person drives
it where he
needs to go

person drives it
to service station
for maintenance

person drives it
continuously to gas
station for fuel

person buys a car

person drives or
rides to dealer

transport it to car
dealers nationwide

assemble the car

make plastics into
seats and knobs

make plastics for interior
furnishings from petroleum

make steel into auto parts

transport steel to auto plant

make ore into steel

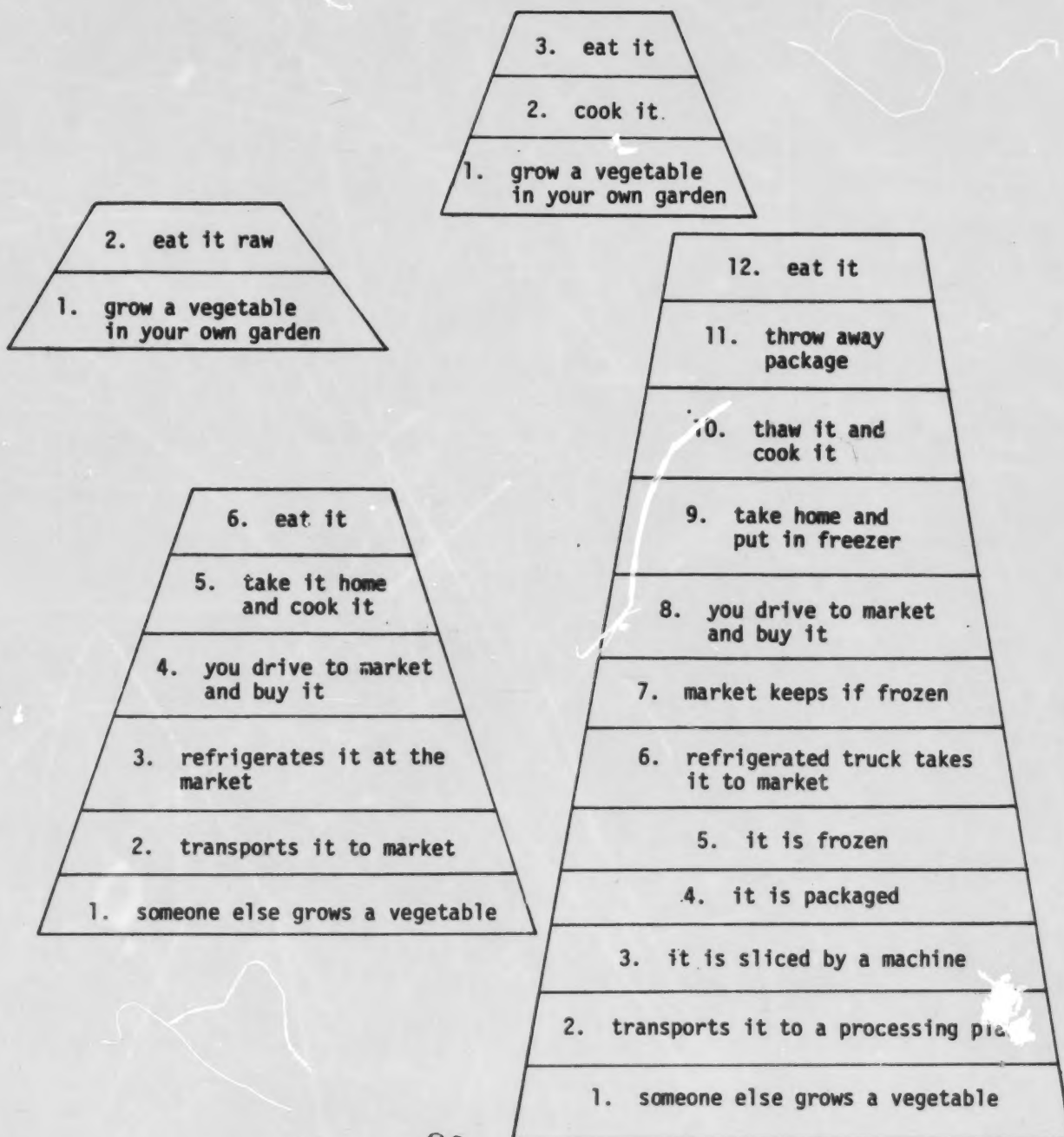
transport ore to steel mill

mine for iron ore

a person needs to go somewhere

WHEN A PERSON NEEDS TO GO SOMEWHERE

WHICH BUDGET IS BETTER?



DIRECTIONS

Learning Station #1

These experiments need to be done at home. Take one worksheet home, complete it, and return it to the basket on this table. Then take another worksheet and do the same.

You need to complete two of these experiments before you proceed to the next station.

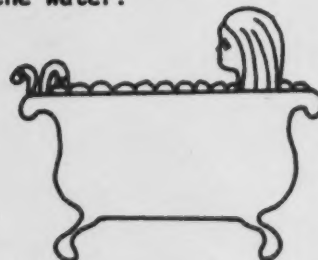
SHOULD YOU SHOWER OR BATHE?

Things you need: your bathtub, a yardstick, a bar of soap (optional)

*A surprising fact is that if people took showers instead of baths a lot of energy would be saved.

TAKE A BATH. Fill your bathtub with water as usual. Before you step into the tub, measure the depth of the water.

Bath water _____ inches



TAKE A SHOWER. Do this when you need one! Before you begin, close the bathtub drain so the shower water will collect in the tub. When you have finished with your shower, measure the depth of the water that has collected.

Shower water _____ inches



What is the difference in the amount of water you used? _____

*It takes about an ounce of oil (or a cubic foot of gas, or 1/4 kilowatt hour of electricity) to heat a gallon of water. Showering saves lots of energy!



A LITTLE DRIP A BIG WASTE



Things you need: an 8 oz. glass or plastic graduated measuring cup, pencil, paper, leaky faucet (optional), clock

Each drop of water from a leaky faucet is tiny but it adds up to thousands of gallons of water dripping from the faucet each year. If it is hot water that is leaking we are also wasting the energy used to heat the water.

If you do not have a leaky faucet, adjust your sink faucet to produce a steady drip. Place the measuring cup beneath the dripping faucet and collect 15 minutes worth of drip. (You might, for example, collect 4 ounces of water in 15 minutes.) Now comes the mathematics so get your paper and pencil! (We'll use the 4 ounce figure in our example.)

Step 1: Multiply the number of ounces of water by 4--this gives you the number of ounces per hour leaking through the faucet.

$$4 \text{ ounces} \times 4 = 16 \text{ ounces per hour}$$

Step 2: Multiply the answer from Step 1 by 24--this gives the number of ounces per day leaking through the faucet.

$$16 \text{ ounces per hour} \times 24 = 384 \text{ ounces per day}$$

Step 3: Multiply the answer from Step 2 by 365--this gives the number of ounces per year leaking through the faucet.

$$384 \text{ ounces per day} \times 365 = 140,160 \text{ ounces per year}$$

Step 4: Divide the answer from Step 3 by 128--this gives the number of gallons per year leaking through the faucet.

$$140,160 \text{ ounces per year} \div 128 = 1095 \text{ gallons per year}$$

*What if your drips are hot? How much energy was wasted then?

Gas fired water heater: Multiply the answer from Step 4 by 0.84.

$$1095 \times 0.84 = 920 \text{ cubic feet of gas per year}$$

Oil fired water heater: Divide the answer from Step 4 by 110.

$$1095 \div 110 = 9.95 \text{ gallons of oil per year}$$

Electric hot water heater: Multiply the answer from Step 4 by 0.25.

$$1095 \times 0.25 = 274 \text{ kilowatt-hours per year}$$

Attach your paper to this sheet when you hand it in.

DIRECTIONS

Learning Station # 2

Read the worksheet directions carefully. Some of these can be done at school while others should be completed at home. When you have completed an experiment, put your sheet in the basket on this table.

You need to complete two of these experiments before you proceed to the next station.

Which is the better

INSULATOR?



Things you need: four or five fruit juice cans, ice cubes, magic marker, items for insulation (as indicated below)

Take four or five fruit juice cans. Place an ice cube in each can and place a number on each can.

- Can #1 - no insulating material (leave as is)
- Can #2 - paint outside of can black
- Can #3 - use styrofoam packaging material
- Can #4 - use newspapers, the same thickness as the styrofoam
- Can #5 - choose one of the other insulating materials from the box

Place all cans either in the sun or in the shade. Check the ice cubes every 15 minutes until the first ice cube has melted. Continue to check until all ice cubes are melted. Record the time it takes to melt each ice cube.

Time

Can #1 _____
Can #2 _____
Can #3 _____
Can #4 _____
Can #5 _____

Insulation used _____

How Does INSULATION

Work?

Things you need: small water glass, "fish tank" thermometer, cardboard box (corrugated cardboard and large enough to hold the water glass), cotton balls

*Insulation in the walls of a home slows down the movement of heat from the inside to the cold outdoors.

Step 1: Fill the glass with water that is at room temperature (about 70° F). Use the thermometer to measure the exact temperature.

Step 2: Put the thermometer into the glass, then put the glass into the refrigerator.

Step 3: Check the water temperature every five minutes.

Check #1 _____

Check #2 _____

Check #3 _____

Check #4 _____

Check #5 _____

Why does the water temperature drop so quickly? Heat flows out of the warm mass into the cold air inside the refrigerator. Let's add insulation to see what it does.

Step 1: Refill the glass with water at room temperature.

Step 2: Place a layer of cotton balls inside the bottom of the cardboard box and rest the glass on top of the layer of cotton.

Step 3: Pack the empty space between the glass and the sides of the box with cotton balls.

Step 4: Repeat as you did for the first part of the experiment.

Check #1 _____

Check #2 _____

Check #3 _____

Check #4 _____

Check #5 _____

Did your "insulation" cause the water temperature to drop less?

Energy Activities

Grade 4

Packet "A"

Master #7

Learning Station #3, pg. 11

DIRECTIONS

Learning Station # 3

Read the experiment sheets carefully. Some of these are to be done at home, some at both home and school. When you complete an experiment, put your sheet in the basket on the table. You need to do two experiments before going to the next station.

How Is It WRAPPED?

When you go shopping with Mom, check to see how the following items are wrapped. Write down what you see.

Meat -
Lettuce -
Oranges -
Toothpaste -
Aspirin -
Potato Chips -

*In many countries of the world food is not packaged as it tends to be in the U. S. The shopper brings her own grocery bag to market and places the unwrapped head of lettuce, unbagged oranges, and meat wrapped only in butcher paper directly into her bag.

Interview your mother, using the following questions.

INTERVIEW WITH MOM

1. Would you use the simpler system found in other countries?
2. What problems do you see?
3. Do you think our present system should be kept?
4. Are you concerned about the amount of packaging materials you now throw away?
5. Do you think the simpler system would save money and energy?

If you believe there is too much overpackaging, write a letter stating your concern to your supermarket manager. Either mail it or hand deliver it.



Look through one of your weekly grocery bags. List the packaging you find and bring the unnecessary packaging to school. Glue the packaging on a sheet of construction paper in a type of collage. Put your name on your collage, staple this sheet to it, and put it in the basket.

<u>Item</u>	<u>Packaging</u>
(example) 1. toothpaste	carton and tube
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	

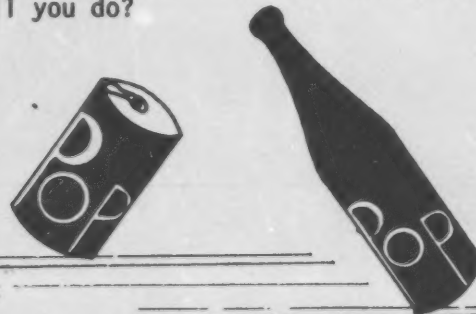
DO RETURNABLE BOTTLES

SAVE ENERGY?

You will need to read the following material in order to answer the questions. Then write a letter to a local or nearby bottling company and ask if they feel it saves money and energy to have returnable bottles. When you get an answer, attach it to this paper. Do you agree with them?

*The purchase of a six-pack of soft drinks in returnable bottles instead of no-deposit no-return containers will save the energy equivalent of .25 liters of gasoline. The saving of 0.25 liters of gasoline can take the average family car about 2 1/2 miles. In addition, when the empty bottles are returned for a 30-cent deposit, the six-pack purchase will have cost 18 cents less than for throw-aways.

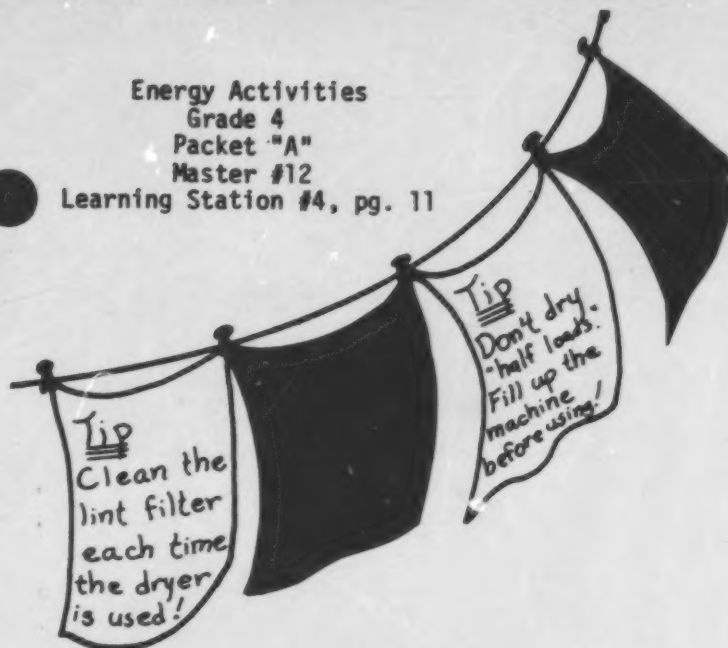
1. If each family in the class purchased one six-pack of returnable bottles each week for one year, how much energy in gasoline will be saved?
2. Using the figure from #1, how many miles of automobile travel are possible with the energy which is saved?
3. How much money is saved?
4. Why do you think so many people still buy beverages in throw-away containers?
5. What do you think the government or people should do about this matter? What will you do?



DIRECTIONS

Learning Station #4

Read the experiment sheets carefully. Some of these are to be done at home and others at school. When you complete an experiment, put your sheet in the basket on the table. You need to do two experiments before going to the next station.



Does Your Clothes Dryer Waste Energy?

Things you need: About one hour
of spare time on washing day, a
clock

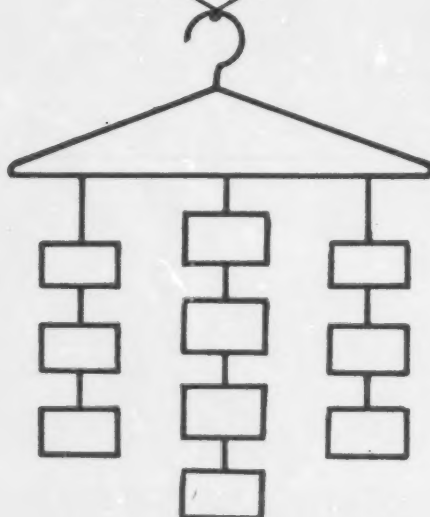
- Step 1: Get permission from Mom! Learn how to restart the machine after you stop it by opening the door. Now you are ready to begin.
- Step 2: When your mother puts the next load in the dryer, pull up a chair and watch the clock.
- Step 3: After 15 minutes goes by, open the dryer door, wait for the drum to stop turning, then feel the clothes. They will probably still be damp.
- Step 4: Close the door and restart the dryer.
- Step 5: Do this again every five minutes until the clothes feel dry to your touch.
- Step 6: Look at the timer to see how much longer the dryer was set to run.

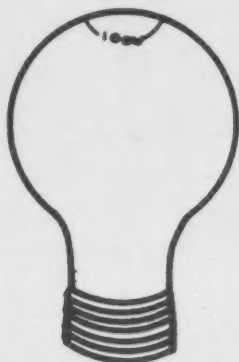
*Electric dryer - every wasted minute burned up about
4/5 ounce of oil.

*Gas dryer - every wasted minute burns about 1/10 cubic
feet of gas.

necessary and **LUXURY** home appliances

1. Use catalogs, magazines, and advertisements for cutting out pictures of things that need electricity. Bring a picture of your home and one of your family to school.
2. Divide your cut-out pictures into two groups: those your family needs and those "extras" they want.
3. Now choose the 10 electrical items you feel are necessary for your family.
4. Make a collage or mobile using your photos and the 10 pictures.





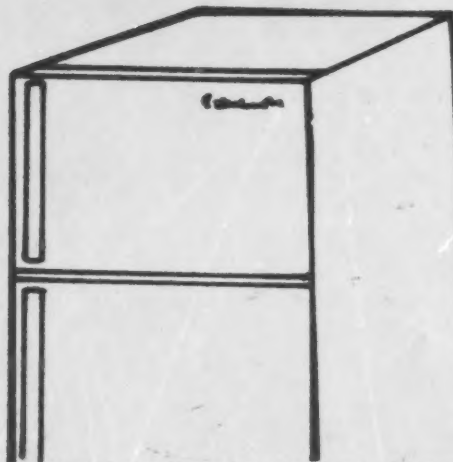
LIGHT AND ENERGY

Things you need: yardstick or tape measure, pencil, and this paper

LIGHTING CHECKLIST

- ☐ Bulbs and lampshades free of dust and dirt?
- ☐ Lampshades translucent (so light can pass through them) rather than solid?
- ☐ Ceilings light-colored?
- ☐ Walls light-colored?
- ☐ "Non-critical" lighting levels kept as low as possible?
- ☐ Does every member of your family turn off lights after he or she leaves a room?

***NOTE:** A light bulb consumes less energy during its starting stage than during a single second of normal operation! Always turn lights off when they are unnecessary, even for a few seconds.



HOW DOES YOUR REFRIGERATOR WORK?

Things you need: an "outdoor" thermometer that reads as low as 30° F, a large bowl or pot, your refrigerator, clock

*Everyday Mistakes which make our refrigerators work harder:

1. Putting warm things in the refrigerator.
2. Opening the refrigerator door more times than necessary.

Step 1: Put your thermometer in the refrigerator, close the door, and wait 15 minutes.

Step 2: Open the door and quickly read the inside temperature. It will be about 40° F. _____

Step 3: Unplug the refrigerator from the wall. Wait 15 minutes then open the door and take a temperature reading. _____

Step 4: Plug the refrigerator back in and wait 15 minutes.

Step 5: Unplug the refrigerator again and every five minutes open the door for 30 seconds. After 15 minutes check the thermometer again. _____

Step 6: Plug the refrigerator back in and wait 30 seconds.

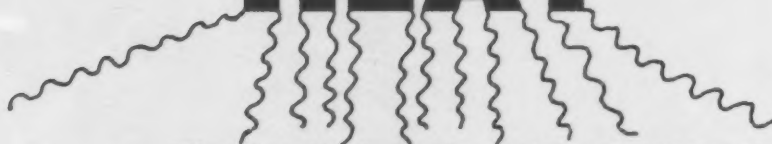
Step 7: Fill your bowl or pot with hot water from the kitchen faucet.

Step 8: Unplug the refrigerator and place the bowl of water inside. Close the door. In 15 minutes take a temperature reading.

LOW
ER

\$AVE MONEY!

HEAT



*Changing the home thermostat setting one degree will generally change heating requirements by about 3 percent. Reducing the setting from 70° F to 69° F will save 3 percent and changing it to 68° F will save 6 percent.

- Step 1: Take this information home to your parents.
- Step 2: Try to get from your parent's the cost of heating their home during the past heating system period.
- Step 3: Find the number of degrees (if any) the present thermostat setting differs from that of the previous year.
- Step 4: Calculate the possible savings by reducing the thermostat to 67° F or 68° F from the one used in the past.

_____ percent saved

Is the savings worthwhile? _____

Can the family live comfortably? _____

Do your parents believe lowering home temperature is a good idea? _____

Energy Activities

Grade 4

Packet "B"

Data Sheet #1

Activity A, 1.1, 2.4, 2.4, pg. 15

OUR "FAMILY" CONSERVES

What can each member of your "family" do to use less natural gas and fuel oil this winter?

Father?

Mother?

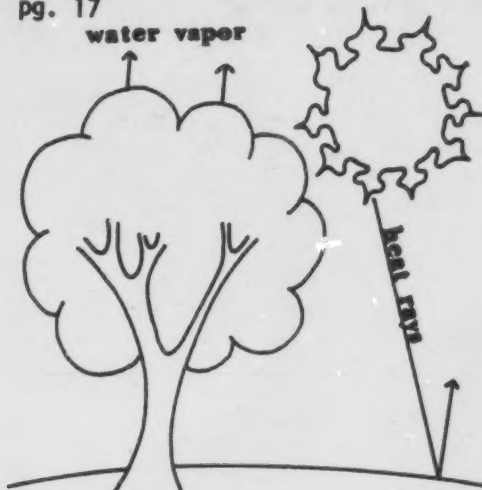
Children?

OUR ENERGY NEEDS

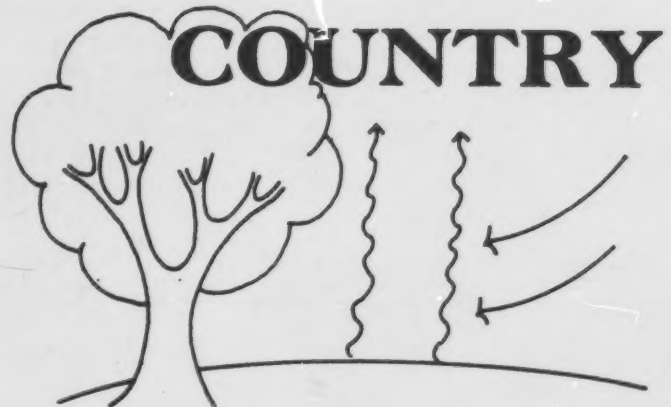
You will find below, the beginning of a list of energy users. Please add to this list. Think about each item and place an "x" in the column under the form of energy that powers the user. Some of the users run on more than one type of energy.

Energy User	Electricity	Coal	Natural Gas	Oil	Battery	Sun
clock	X				X	
green plant						
television						
stove						
furnace						
radio						
flashlight						
lamp						
refrigerator						

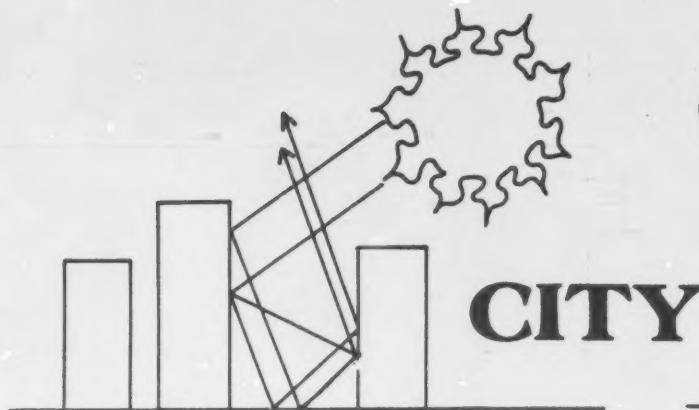
MAN AND HIS CITIES



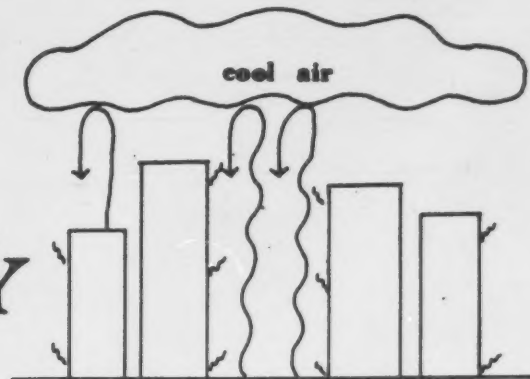
Most energy from sun is used in the evaporation of water.



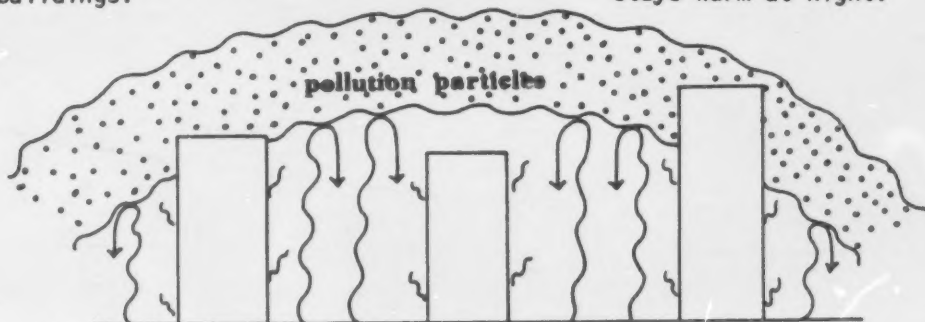
Heat in ground rises rapidly at night and cool air replaces it.



Sun's heat is captured and held by building surfaces.
 Air is heated by the warmed surfaces of the buildings.



Rooftops and streets cool quickly and this forms a blanket of cool air which traps warm air. City stays warm at night.



Cars, furnaces, factories, buses add heat and pollution to the cities. The pollution particles block the rising heat and keep it from moving out of the city.

TRAFFIC SURVEY

Name _____

Date _____

Type of Vehicle

How Many?

Car

Truck

Bus

Van

Pick-up

Motorcycle

Bicycle

SCHOOL SURVEY OF BIKE AND CAR USERS

Grade Level: _____

Student's Name	Bike	Car	Walk	Why Doesn't Ride Bike More Often?
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20			2	84

EXPERIMENT IN ENERGY AND LIFESTYLE

	Slow Driver	Fast Driver
Distance covered	1000 miles	1000 miles
Elapsed time	20 hr., 43 min.	20 hr., 12 min.
He passed	645 cars	2004 cars
He was passed by	142 cars	13 cars
He used brakes	652 times	1339 times





HOW I USE ELECTRICITY IN MY HOME

Listed below are many electrical appliances used in American homes every day. Check each item you have in your home. If you use (operate) the item yourself, use a double check. If you think of other items you or your family use, add them to the list.

- | | | |
|--|--|---|
| ☐ air conditioner | ☐ hair curler | ☐ orange squeezer |
| ☐ food blender | ☐ clothes dryer | ☐ pencil sharpener |
| ☐ dehumidifier | ☐ electric fan | ☐ electric stove |
| ☐ humidifier | ☐ space heater | ☐ waffle iron |
| ☐ dishwasher | ☐ lamps | ☐ toaster |
| ☐ door bell | ☐ musical | ☐ sandwich grill |
| ☐ back massager | ☐ instruments | ☐ griddle |
| ☐ electric blanket | ☐ refrigerator | ☐ frying pan |
| ☐ can opener | ☐ tank filter | ☐ electric oven |
| ☐ clock | ☐ (aquarium) | ☐ electric shaver |
| ☐ coffee maker | ☐ hedge cutter | ☐ rug shampooer |
| ☐ slide viewer | ☐ electric typewriter | ☐ slide projector |
| ☐ shoe polisher | ☐ iron | ☐ home movie |
| ☐ electric circular | ☐ vacuum cleaner | ☐ projector |
| ☐ saw | ☐ radio | ☐ tape recorder |
| ☐ drill sander | ☐ television | ☐ garage door |
| ☐ electric tooth- | ☐ warming tray | ☐ opener |
| ☐ brush | ☐ bun warmer | ☐ water softener |
| ☐ washing machine | ☐ floor polisher | ☐ snowblower (elec.) |
| ☐ electric mixer | ☐ record player | ☐ mower (elec.) |
| ☐ hair dryer | ☐ electric knife | |

WHERE DID WE GO?

Name _____

With the help of your parents tell where you went on vacations for the past 3 years. Include the amount of travel involved. On the back side plan a new kind of vacation.

	Where we went	Miles	Days
Year _____			
Year _____			
Year _____			



EATERS

1. Energy Eaters at Home

List the most important energy eaters first.

- A.
- B.
- C.
- D.
- E.
- F.
- G.
- H.

I listed these "Energy Eaters" first because:

2. Circle the "Energy Eater" in number 1 you could change to use less energy. How would you change the device or how it is used?

3. To make changes in number 2, how would you and your family have to change your personal habits or wants to make the plan work?

4. Circle the number that matches your feeling about the changes mentioned in number 3 above.

- 5 - Very Willing to Change
- 4 - Willing to Change
- 3 - No Difference
- 2 - Unwilling to Change
- 1 - Very Unwilling to Change

INTERVIEW MOM

Name _____

Ask your mother the following questions as if you were interviewing her. Write her responses on this paper and return it to school.

1. Would you be willing to use a simpler system at the grocery store, more like the one found in many countries?
2. What problems do you see?
3. Do you think our present system should be kept?
4. Are you concerned about the amount of packaging material you now throw away?
5. Do you think the simpler system would save energy and money?

SCORE CARD

Name	2 minute score	1 minute score	Total score

Energy Activities
Grade 4
Packet "B"
Situation Cards
Activity C, 2.1, pg. 22
Situation Card #1

DINNER?

Energy Activities, Grade 4, Packet "B"

It is a hot summer day and Mom asks for suggestions for dinner. Would you:

- A. Pile in the car and drive to a drive-in restaurant.
 - B. Tell Mom you want roast, potatoes, bread.
 - C. Start the charcoal in the outdoors grill for hamburgers.
 - D. Eat a cold salad.
 - E. Other...
-

CAMP IN THE DARK?

Situation Card #2

Energy Activities, Grade 4, Packet "B"

You go camping with your family one weekend. In the evening, you would like to read a book before going to bed. Would you:

- A. Use the campfire for reading.
 - B. Use a flashlight in your tent.
 - C. Forget about reading and sing songs with your family around the fire.
 - D. Go to bed.
 - E. Other...
-

SHOWER OR BATH?

Situation Card #3

Energy Activities, Grade 4, Packet "B"

Mom wants you to wash up every day, but she warns you not to be wasteful! Would you:

- A. Insist on hot showers all the time.
 - B. Learn to get clean in cool showers.
 - C. Learn to take showers instead of baths.
 - D. Take a quick bath each day.
 - E. Other...
-

HOW DO I GET THERE?

Situation Card #4

Energy Activities, Grade 4, Packet "B"

You live two miles from school and your parents have left it up to you to decide the best way to get to school each day. Would you:

- A. Start out early and walk.
- B. Ask Mom or Dad to take you in the car.
- C. Ride a bus.
- D. Ride your bicycle.
- E. Other...

BRRR!!

Situation Card #5

Energy Activities, Grade 4, Packet "B"

It is very cold outside, the house doesn't feel too warm, and your sister is not feeling well. Would you:

- A. Turn up the thermostat so she doesn't catch a chill.
 - B. Put warm clothes and a blanket on her.
 - C. Start a fire in the fireplace.
 - D. Other...
-

CHILLS

Situation Card #6

Energy Activities, Grade 4, Packet "B"

On the first cold winter day you feel a draft coming through the windows. Would you:

- A. Ask Dad to caulk the windows.
 - B. Help Dad put on storm windows.
 - C. Turn up the thermostat.
 - D. Close the curtains.
 - E. Other...
-

SURPRISE

Situation Card #7

Energy Activities, Grade 4, Packet "B"

Dad surprises Mom with a clothes dryer on her birthday. Mom is so excited she says she will never have to hang clothes on the line again! Would you:

- A. Tell Mom to hang clothes outside when it is nice.
 - B. Let her use the dryer all the time.
 - C. Let her dry small loads whenever she wants to.
 - D. Other...
-

COOL IT!

Situation Card #8

Energy Activities, Grade 4, Packet "B"

On a hot summer day you want to get cooled off. Would you:

- A. Turn on the air conditioner.
- B. Turn on the fan.
- C. Jump in the heated pool.
- D. Fan yourself with a stiff piece of paper.
- E. Other...

MY ACTION WORKSHEET

(✓) those things you have done

(x) those things you would like to try

Write a Letter

- ___ 1. Write a letter to the editor of your local newspaper. You can influence public opinion.
- ___ 2. Write a letter to your Congressmen or your Senators. Compliment them for something they may have done about a problem dealing with energy. They are influenced by the mail from home.
- ___ 3. Send a letter to someone in the news who has done something you respect or admire.

Attend a Meeting or Organize One

- ___ 1. Write one of the organizations working for a cause you believe in and ask to be put on the mailing list.
- ___ 2. Ask one of the clubs to which you belong (Boy Scouts, Girl Scouts, etc.) to invite a guest speaker on energy.

Take Part in Some Action

- ___ 1. You can distribute leaflets from door to door.
- ___ 2. Organize a petition drive. Even 20 signatures could make news.
- ___ 3. Interview people who are in a position to influence others.
- ___ 4. Wear a button.

Facts to Face Acts

- ___ 1. Speak up for your point of view.
- ___ 2. Try to close the gap between what you say and what you do.

READING AN ELECTRIC METER



READING = 13488



READING = 35721



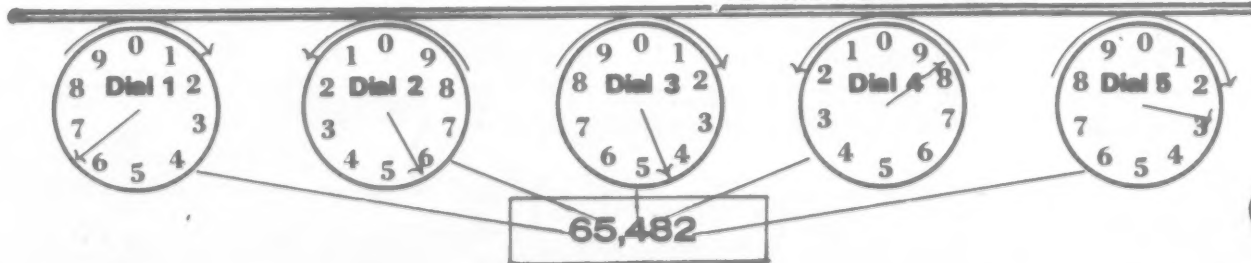
READING = 66190

Monday morning meter reads 13478

Tuesday morning meter reads 13488

How much has home consumed? $\begin{array}{r} 13488 \\ -13478 \\ \hline \end{array}$

10 kilowatt - hours



READING A GAS METER



READING = 4846

Sunday meter reading is 4786

Next Sunday meter reading is 4846

How much has home consumed?

4846

-4786

60 'units' of gas

Each 'unit' = 100 cubic-feet of gas

$60 \times 100 = 6,000$ cubic-feet of gas

HOW MUCH GAS OR ELECTRICITY DO WE USE?

Name _____

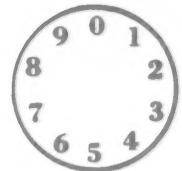
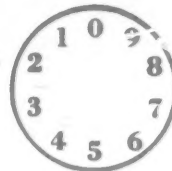
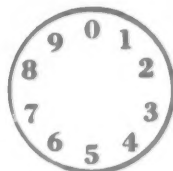
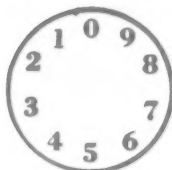


_____ Time _____ READING _____

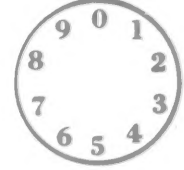
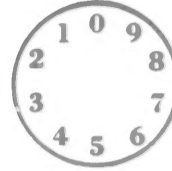
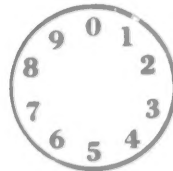
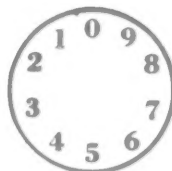


Date _____ Time _____ READING _____

TRY TO SAVE ENERGY!



Date _____ Time _____ READING _____



Date _____ Time _____ READING _____

Date _____

Time _____




READING _____

Date _____

Time _____




READING _____

TRY TO SAVE ENERGY!

Date _____

Time _____



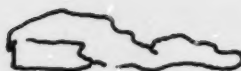

READING _____

Date _____

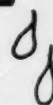
Time _____




READING _____



PRESERVING AN ICE CUBE



Group's plan to prevent the ice cubes from melting so quickly _____

Time

Start _____

Which material worked best?

Stop _____

Group's plan to prevent the ice cubes from melting so quickly _____

Time

Start _____

Which material worked best?

Stop _____

Dear Parents,

Your child is currently involved in learning more about how energy affects our lives and how energy can be changed from one form to another. Energy crisis, energy shortage, higher utility bills, etc. all have increasingly become a portion of our daily living. In order that the children of today can become better able to act as responsible citizens of tomorrow, we need to act now. U. S. energy consumption doubles every 13 to 15 years. This is frightening when we realize that we depend heavily upon nonrenewable resources to supply our energy and these will not be available one day.

Please use the following questions to help you in starting a family discussion about energy. You can certainly add to the list if you feel it is necessary! I feel that once everyone becomes involved in this type of discussion, school will be more meaningful for the child, the home will be able to share in the child's experiences, and it is one way for them to feel they have influence in decision making.

Thank you!

Questions

1. How many times is a source of energy changed before we use it to heat our home? To cook?
2. Are there ways we could reduce the number of conversions before we use an energy source?
3. What energy "needs" do we have? What are our energy "wants"?
4. Why is there an energy shortage?
5. What can we do to reduce the amount of energy we use in transportation and in our home?
6. Will our life change much if we cut down on our energy use? Will the change be good for us?
7. What can we do to help others understand more about energy shortages and what we can do?

CONSERVATION QUIZ

Dripping hot water faucet	Room with thermostat set at 58° or lower	Lights on in an unoccupied room	Electric can opener	Car making a quick stop	Washing machine with cold water only
Grow a garden	Electric blanket	Doors and windows closed in cold weather	Car easing to a smooth stop	TV off when no one watching	Car pool
Public building too hot or too cold	Fluorescent lights	Outside lights burning during the day	Lamps with more than 70 watt bulbs	Car with only one passenger	Take showers instead of baths
Car coming to a quick stop	Wear sweaters and warm clothing in cold weather	Bicycle instead of using car	Electric toothbrush in use	People walking to work or school	Car speeding over 55 mph
Sun allowed to shine into home to give warmth	Color TV	Door or window open with heat or air conditioning on	Full loads in the washing machine	Room with thermostat above 68°	Conserve paper
Car idling with no driver	Lights off when no one using them	Electric knife in use	House with no storm windows	Clothes hanging out to dry	Recycling of paper, glass, metal

Directions

1. Mark each block with an x when you actually find what is described.
2. Color the blocks red which show a waste of energy.
3. Color the blocks yellow which show saving of energy.

SHOWER OR BATH

Fill the bathtub as usual.

Before bathing, measure the depth of the water in inches.

Bath water _____ inches

Take a shower.

Before you begin the shower, close the bathtub drain so that your shower water will collect in the tub. After taking the shower, measure the depth of water collected in the tub.

Shower water _____ inches

Which used less hot water?

By how much?